DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 11-2601**

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER **TO 16-30TRC-5**

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RADIO SETS

AN/TRC-1, -1A, -1B, -1C, -1D, -1E, AND -1G;

RADIO TERMINAL SETS

AN/TRC-3, -3A, -3B, -3C, -3D, -3E, AND -3G;

RADIO RELAY SETS

AN/TRC-4, -4A, -4B, -4C, -4D, -4E, AND -4G;

AND

AMPLIFIER EQUIPMENTS

AN/TRA-1, -1A, -1B, -1C, AND -1D.

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
DECEMBER 1951

TM 11-2601 • TO 16-30TRC-5

This manual supersedes TM 11-2601, 9 June 1945; TM 11-4029, 10 December 1945; TM 11-4031, 15 November 1945; TM 11-4039, 11 October 1945; TM 11-4505, 10 September 1945; TB 11-2601-1, 31 March 1945; TB 11-2601-2, 1 August 1945; and TB 11-2601-3, 28 October 1947.

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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *19 December 1951*

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For explanation of distribution formula, see SR 310-90-1.

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WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if operating personnel fail to observe safety precautions

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SAFETY NOTICE

Voltages as high as 4,700 volts are used in the operation of this equipment. These voltages are dangerous to life.

Do not change tubes or make adjustments inside the set with the high voltage supply ON.

A few service checks must be made inside the set with the high voltage on. When making these checks, always have the immediate presence and assistance of another person capable of rendering aid. Keep one hand in your pocket while making high voltage measurements. This will prevent touching the electrical circuit with more than one part of the body at one time.

Be sure that high-voltage plate circuits are dead before performing preventive maintenance on this equipment. High-voltage capacitors in power supplies must be discharged manually before performing maintenance operations.

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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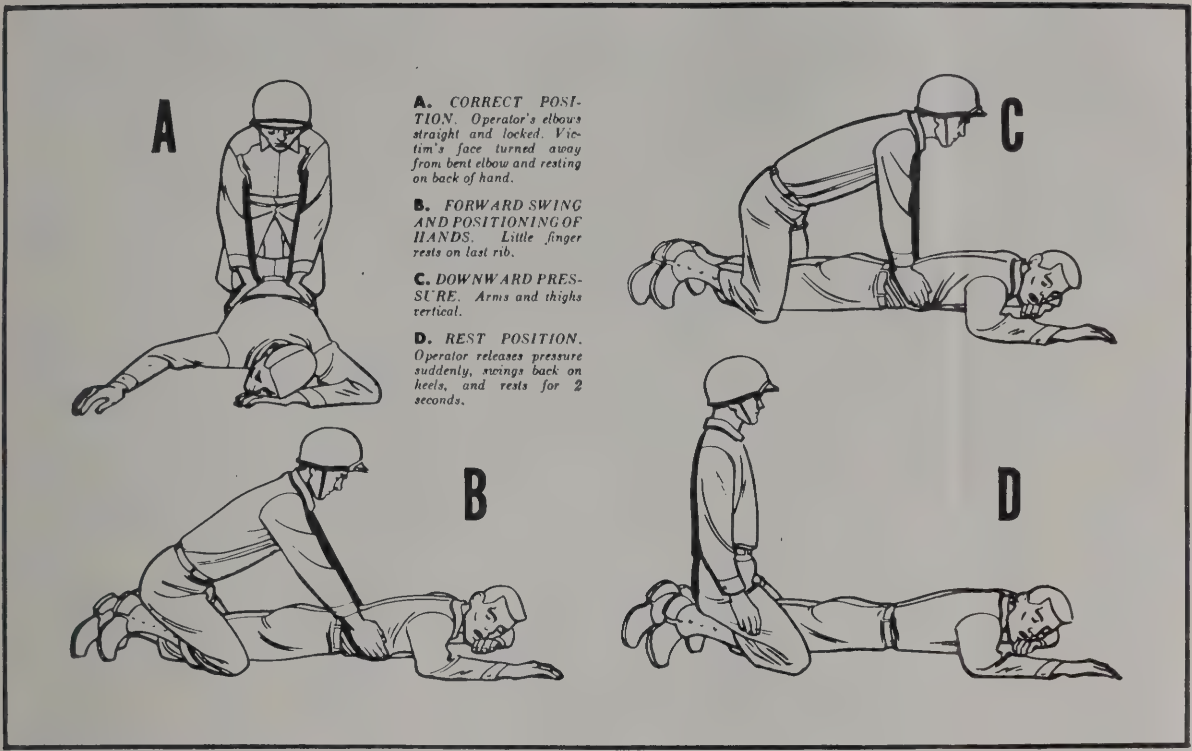


seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

Figure 1. Radio Terminal Sets AN/TRC–3(*) and Radio Relay Sets AN/TRC–4(*) in use.

This manual supersedes TM 11–2601, 9 June 1945; TM 11–4029, 10 December 1945; TM 11–4031; 15 November 1945; TM 11–4039, 11 October 1945; TM 11–4505, 10 September 1945; TB 11–2601–1, 31 March 1945: TB 11–2601–2, 1 August 1945; and TB 11–2601–3, 28 October 1947.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This technical manual contains instructions for the installation, operation, maintenance, and repair of Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), Radio Relay Set AN/TRC–4(*), and Amplifier Equipment AN/TRA–1(*). Particular emphasis is placed on the use of these sets in four-channel carrier-telephone and telegraph systems. In addition, instructions are given for the use of these sets in single-channel point-to-point and radio-relay signal communication systems. Information concerning the transmission and propagation characteristics of radio waves at the frequencies used also is given; these characteristics must be considered in planning and installing radio circuits with these equipments. There are also three appendixes covering a list of references, an identification table of parts, and tables of components. The installation and operation instructions are in paragraphs 52 through 156; the theory and repair information is in paragraphs 185 through 281 of this manual.

b. Official nomenclature followed by (*) is used to indicate the following models of equipment included in this manual:

(1) Radio Set AN/TRC–1(*) represents Radio Sets AN/TRC–1, –1A, –1B, –1C, –1D, –1E, and –1G.

(2) Radio Terminal Set AN/TRC–3(*) represents Radio Terminal Sets AN/TRC–3, –3A, –3B, –3C, –3D, –3E, and –3G.

(3) Radio Relay Set AN/TRC–4(*) represents Radio Relay Sets AN/TRC–4, –4A, –4B, –4C, –4D, –4E, and –4G.

(4) Amplifier Equipment AN/TRA–1(*) represents Amplifier Equipments AN/TRA–1, –1A, –1B, –1C, and –1D.

(5) Antenna System AS–19(*)/TRC–1 represents Antenna Systems AS–19/TRC–1, AS–19A/TRC–1, AS–19B/TRC–1, AS–19C/TRC–1, AS–19D/TRC–1, AS–19E/TRC–1, and AS–19F/TRC–1.

(6) Radio Transmitter T–14(*)/TRC–1 represents Radio Transmitters T–14/TRC–1, T–14A/TRC–1, T–14B/TRC–1, T–14C/TRC–1, R–14D/TRC–1, T–14E/TRC–1, and T–14H/TRC–1. Many of the circuits of the unlettered through E models have been modified by modification work orders to the equivalent of the H model.

(7) Radio Receiver R–19(*)/TRC–1 represents Radio Receivers R–19/TRC–1, R–19A/TRC–1, R–19B/TRC–1, R–19C/TRC–1, R–19D/TRC–1, R–19E/TRC–1, and R–19H/TRC–1. Many of the circuits of the unlettered through E models have been modified by modification work orders to the equivalent of the H model.

(8) Amplifier AM–8(*)/TRA–1 represents Amplifiers AM–8/TRA–1, AM–8A/TRA–1, AM–8B/TRA–1, AM–8C/TRA–1, and AM–8D/TRA–1.

(9) Power Supply PP–13(*)/TRA–1 represents Power Supplies PP–13/TRA–1, PP–13A/TRA–1, PP–13B/TRA–1, PP–13C/TRA–1, PP–13D/TRA–1, and PP–13E/TRA–1.

(10) Antenna Support AB–33(*)/TRC–1 represents Antenna Supports AB–33/TRC–1, AB–33A/TRC–1, AB–33B/TRC–1, and AB–33C/TRC–1.

(11) Antenna AS–20(*)/TRC–1 represents Antennas AS–20/TRC–1, AS–20A/TRC–1, AS–20B/TRC–1, AS–20C/TRC–1, AS–20D/TRC–1, and AS–20F/TRC–1.

(12) Test Oscillator TS–32(*)/TRC–1 represents Test Oscillators TS–32/TRC–1, TS–32A/TRC–1, TS–32B/TRC–1, TS–32C/TRC–1, and TS–32D/TRC–1. Circuits of the unlettered through B models have been modified by modification work orders to the equivalent of the C model.

(13) The various models of power units, cases, chests, bags, and control boxes are represented by (*).

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army matériel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), NAV DEPT SERIAL 85P00 (Navy), and AFR 71–4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 AFR 65–26.

d. DA AGO Form 419, Preventive Maintenance Checklist for Signal Corps Equipment, will be prepared in accordance with instructions on the back of the form.

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

See paragraphs 42 through 51 for system application.

a. Radio Set AN/TRC–1(*).

(1) Radio Set AN/TRC–1(*) consists of an f-m (frequency-modulated) radio transmitter and an f-m radio receiver together with the necessary accessories to set up a v-h-f (very-high-frequency) field radio station. Radio Set AN/TRC–1(*) is a transportable radio set intended for either point-to-point use or, in radio-relay applications, as a terminal or repeater. It provides single-channel communication in both directions simultaneously (duplex operation) or single-channel communi-

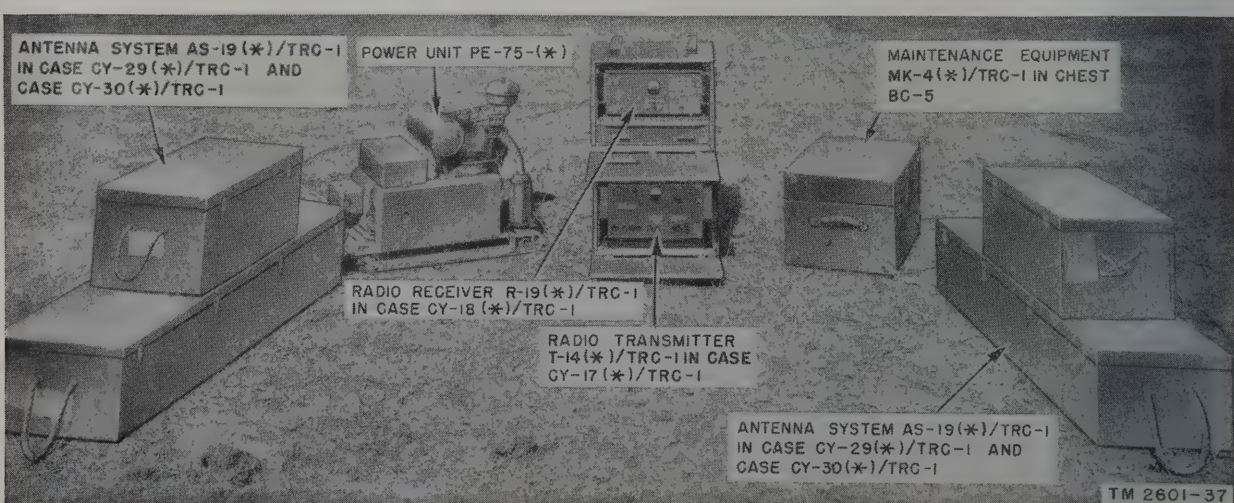
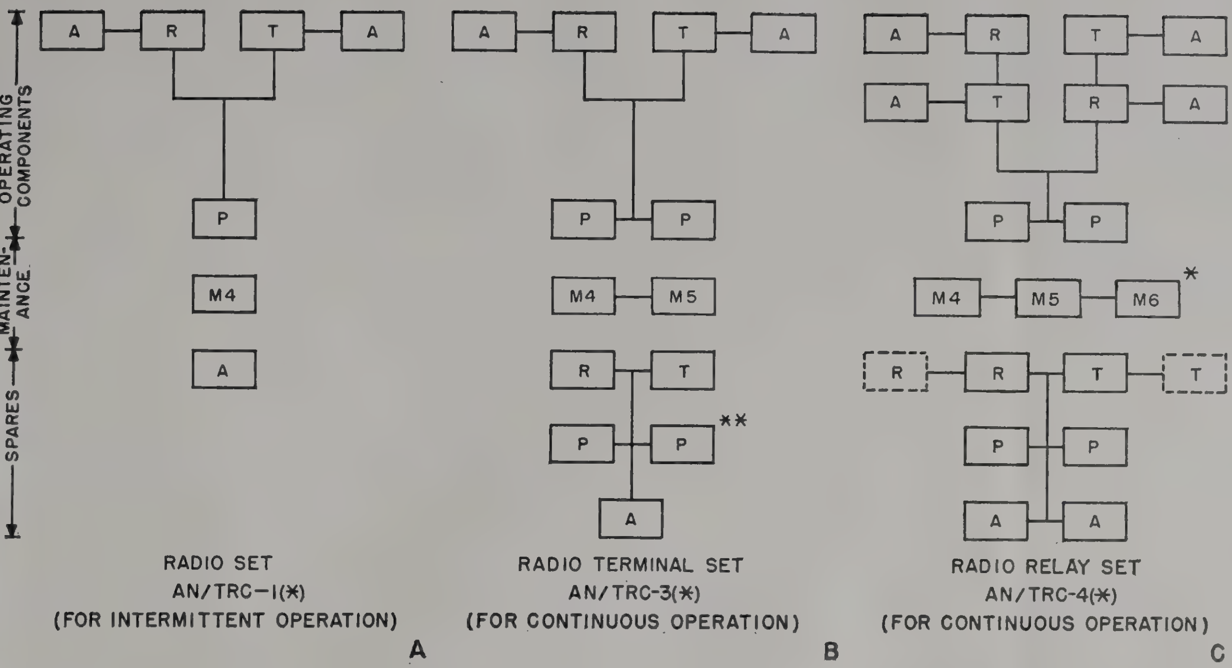


Figure 2. Operating Components of Radio Set AN/TRC–1 through –1E.



KEY

R = RADIO RECIEVER R-19(*)/TRC-1.
T = RADIO TRANSMITTER T-14(*)/TRC-1.
P = POWER UNIT PE-75-(*)(SETS ISSUED FOR OPERATION INSIDE Z/I DO NOT HAVE POWER UNITS).
A = ANTENNA SYSTEM AS-19(*)/TRC-1.
M4 = MAINTENANCE EQUIPMENT MK-4(*)/TRC-1 OR ACCESSORY KIT NO.1.
M5 = MAINTENANCE EQUIPMENT MK-5(*)/TRC-3 OR ACCESSORY KIT NO. 2.
M6 = MAINTENANCE EQUIPMENT MK-6(*)/TRC-4 OR ACCESSORY KIT NO.3.

NOTES:

* ACCESSORY KIT NO. 3 NOT INCLUDED IN LATE G MODELS.
** SOME G MODELS ISSUED WITH THREE POWER UNITS.
COMPONENTS IN DASHED RECTANGLES ARE EXTRA SPARES IN RADIO RELAY SET AN/TRC-4G

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Figure 3. Components of Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), and Radio Relay Set AN/TRC–4(*).

cation in one direction at a time (simplex operation). This set also may be used for multichannel communication when continuous service is not required. This radio set is not intended for continuous 24-hour service; therefore, no spare transmitters or receivers are provided and the maintenance equipment furnished is limited.

(2) Each set covers a frequency range of 70 to 100 mc (megacycles) with a nominal power output of 40 watts on any one preset crystal-controlled frequency within this range. Provisions are made for lowering the power output to less than 10 watts by means of a panel switch and increasing it to approximately 200 watts by means of an auxiliary power amplifier. Each component is housed and shock-mounted separately in a weatherproof wooden carrying case.

(3) Provision is made for coupling to the spiral-four cable when used in the multichannel carrier-telephone radio-relay circuits. Self-contained 115-volt 60-cycle a-c (alternating-current) operated power supplies are included in each radio transmitter and radio receiver. All equipments are powered from regular commercial power when available, or by means of the gasoline engine-driven alternator, Power Unit PE–75–(*), supplied with each set.

(4) Each set has complete antenna and mast equipment for any mode of operation. Horizontally polarized directional arrays are ordinarily used for transmitting and receiving and are elevated 40 or 50 feet above the ground by

means of portable masts. Early models of the mast are 40 feet and late models are 50 feet in height. Vertically polarized antennas are available with the latest models. MWO SIG 11–2601–4 authorizes requisition of material for rhombic antenna construction.

(5) Each set is complete with sufficient running spares and operating equipment for field use. Sufficient tools and spare parts are supplied in kit form for limited maintenance of the radio set. Radio Set AN/TRC–1(*) normally consists of Radio Transmitter T–14(*)/TRC–1, Radio Receiver R–19(*)/TRC–1, three Antenna Systems AS–19(*)/TRC–1, Power Unit PE–75–(*), and accessory components (figs. 2 and 3–A).

b. Radio Terminal Set AN/TRC–3(*). Radio Terminal Set AN/TRC–3(*) consists of two Radio Receivers R–19(*)/TRC–1 (one in use, one spare), two Radio Transmitters T–14(*)/TRC–1 (one in use, one spare), three Antenna Systems AS–19(*)/TRC–1, three Power Units PE–75–(*) (two in use, one spare), accessory components, and spare parts for maintenance (fig. 3–B). (Some procurements of Radio Terminal Set AN/TRC–3(*) have three Power Units PE–75–(*).) The components, except in quantity, are identical with those of Radio Set AN/TRC–1(*). This equipment is intended for operation at the terminals of a single-channel or multichannel radio-relay system when continuous operation is required. Components not in use are running spares which are supplied to insure uninterrupted service in case of failure of a major component.

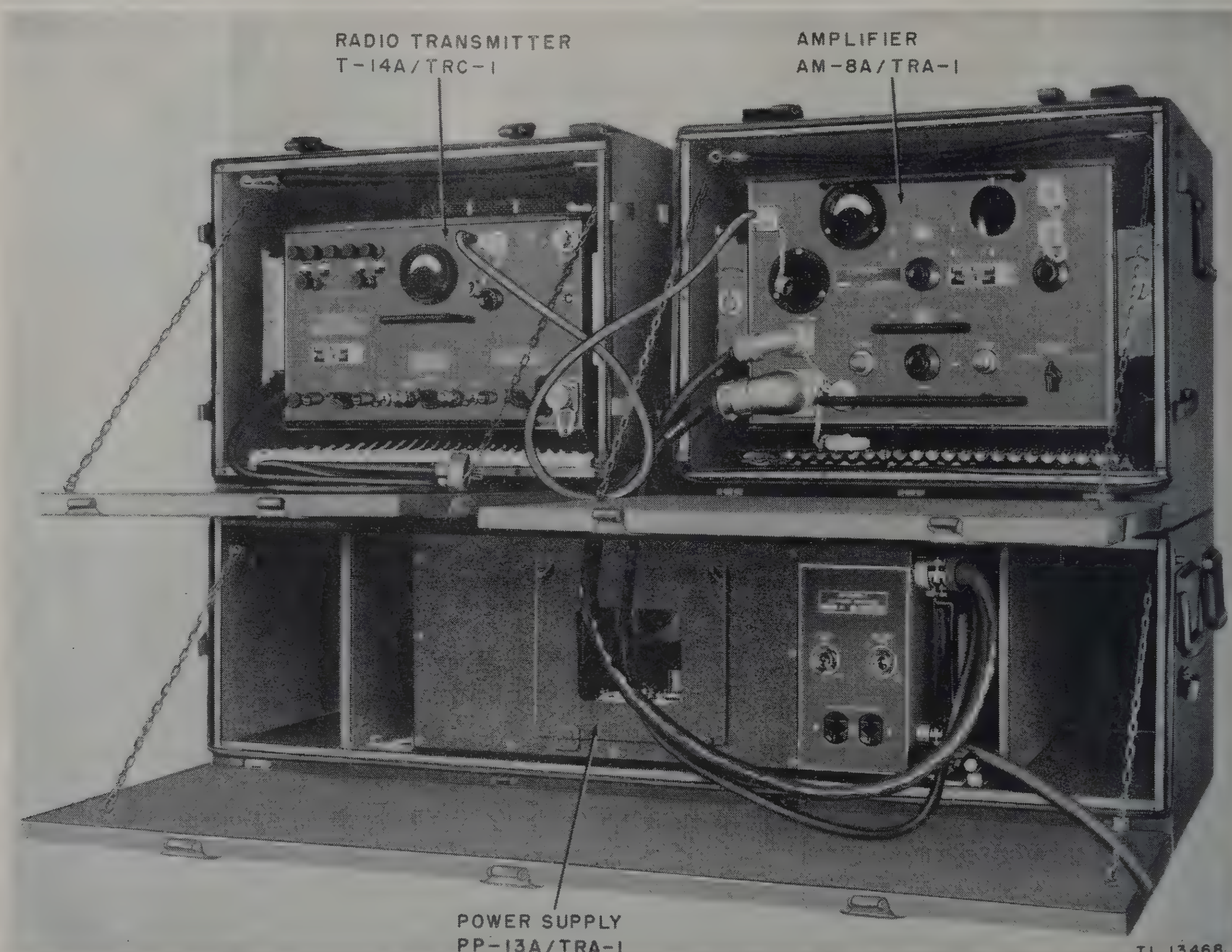

Figure 4. Amplifier Equipment AN/TRA–1A, with Radio Transmitter T–14A/TRC–1.

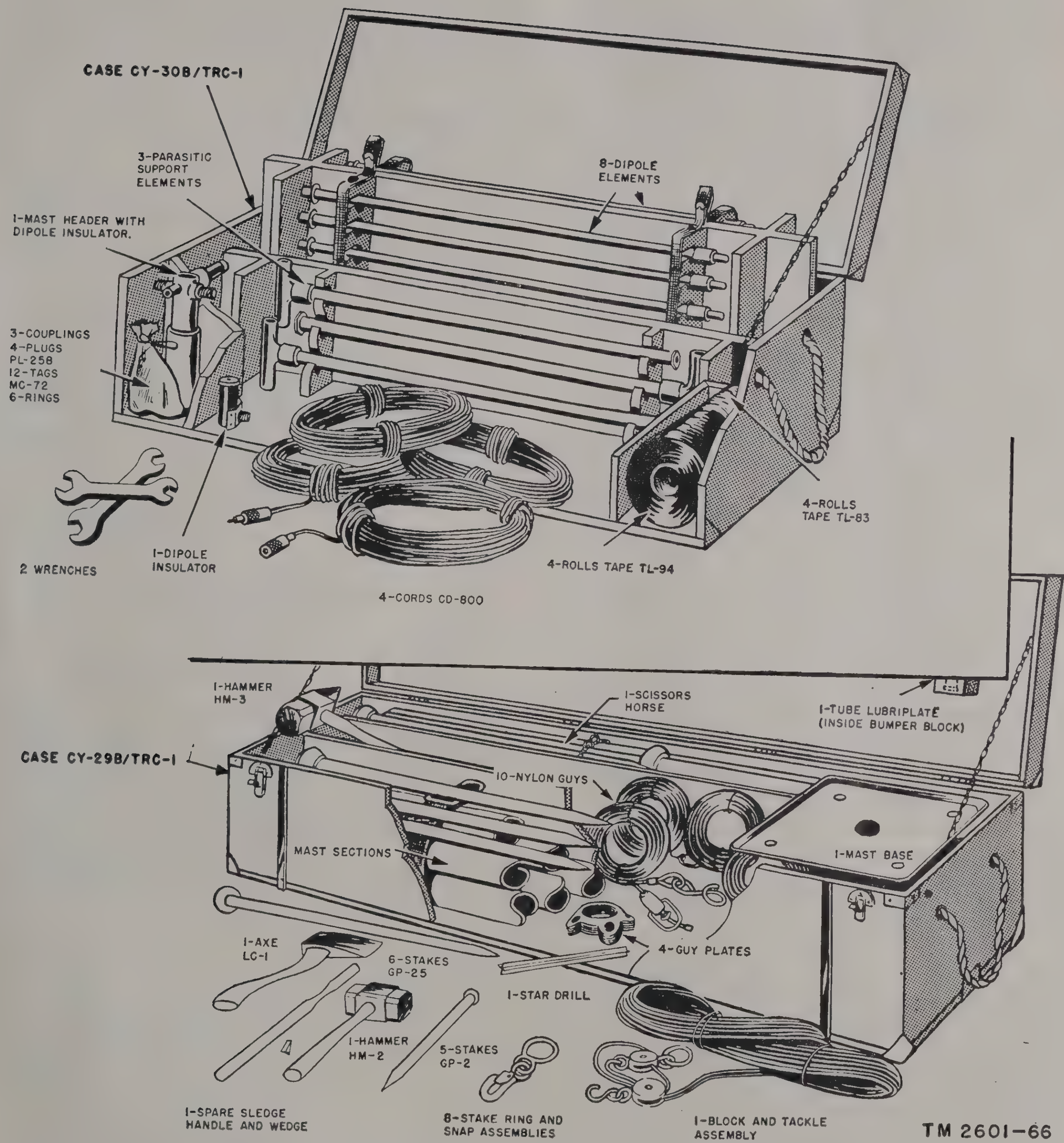

Figure 5. Components of Antenna System AS-19B/TRC-1.

Operating accessories and maintenance equipment supplied are chosen with due regard for the contemplated continuous service.

c. Radio Relay Set AN/TRC-4(*).

(1) Radio Relay Set AN/TRC-4(*) consists of three Radio Receivers R-19(*)/TRC-1 (four in Radio Relay Set AN/TRC-4G), three Radio Transmitters T-14(*)/TRC-1 (four in Radio Relay Set AN/TRC-4G), six Antenna Systems AS-19(*)/TRC-1, four Power Units PE-75-(*), accessory components, and spare maintenance parts (fig. 3-C). Two each of the receivers, transmitters, and power units will be in use, the others are spares.

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(2) This equipment is intended for operation as a *relay station* of a single-channel or multichannel radio-relay communication system when continuous operation is required. Running spares and maintenance equipment are furnished to insure uninterrupted service in case of failure of a major component. Operating accessories and maintenance equipment have been selected with due regard for the continuous service the repeater set is expected to furnish under isolated conditions.

(3) Radio-relay systems are used as connecting links in wire communication networks where the terrain features are such that the laying of wire facilities is not feasible. The frequency range of this equipment (70 to 100 mc) is such that for optimum operation there should be an unobstructed line-of-sight transmission path between two stations.

d. Amplifier Equipment AN/TRA–1(*). Amplifier Equipment AN/TRA–1(*) consists of 200-watt r-f (radio-frequency) power Amplifier AM–8(*)/TRA–1, Power Supply PP–13(*)/TRA–1, accessory components, and spare maintenance parts. This equipment is used in conjunction with Radio Transmitter T–14(*)/TRC–1 (fig. 4) when more power is required to maintain good communication under adverse conditions, such as unfavorable terrain or long spans between stations.

e. Antenna System AS–19(*)/TRC–1. Antenna System AS–19(*)/TRC–1 contains all the equipment necessary to erect a three-element v-h-f directional array in the field for use with Radio Receiver R–19(*)/TRC–1 or Radio Transmitter T–14(*)/TRC–1. The antenna system includes the antenna array, a 40- or 50-foot mast (depending on the model), coaxial transmission lines, and all installation equipment. The complete system is packed in two wooden carrying cases in the unlettered through C models; it is packed in five cases, one carrying frame, and one canvas bag in the D, E, and early F models. Late F models are packed in five cases, a carrying frame, and two canvas bags. Separate antennas are required for the receiver and the transmitter if duplex operation is desired. A cutaway view of a representative antenna system, packed in two carrying cases, is shown in figure 5.

4. Technical Characteristics of Radio Transmitter T–14(*)/TRC–1

Frequency range	70.0 to 99.9 mc (300 channels).
Transmitter type	Crystal-controlled f-m.
Type of signals transmitted	Broad-band audio.
Distance range	Line of sight (maximum of 150 miles).
Type of modulation	F-m, as derived from phase modulator.
Number of tubes	11.
Power input	250 watts at 115 volts ac, 50 to 60 cps (cycles per second).
Power output	40 watts maximum, 10 watts on low power.
Type of transmission	Voice, multichannel telephone, telegraph, facsimile, or a combination of these.
Crystals:	
Type	Crystal Unit CR–4B/U.
Frequency range	729.167 to 1,040.625 kc (kilocycles).
Multiplication in transmitter	96 times on all frequencies.
Frequency deviation	±30 kc.
Output impedance	50 to 100 ohms into coaxial cable.
Audio response:	
High-fidelity channel	±1 db (decibel), 500 to 12,000 cps; +0 to −2 db, 250 to 500 cps.
Microphone channel	±3 db, 250 to 2,500 cps; −30 db, 3,000 cps and above.
Audio input level	0 to −12 dbm (db referred to 1 mw (milliwatt)) for 9-kc deviation.
Audio input impedance:	
High-fidelity channel	500 ohms.
Microphone channel	30 to 50 ohms (for single-button carbon microphone).
Microphone supply	Self-contained for microphone channel.
Antenna	Half-wave dipole with director and reflector elements (supported by 40— or 50-foot mast) or v-h-f rhombic.
Weight (in Case CY–17(*)/TRC–1)	108 pounds.

5. Technical Characteristics of Radio Receiver R–19(*)/TRC–1

Frequency range	70.0 to 99.9 mc (300 channels).
Receiver type	Double conversion superheterodyne.
Type of signal received	F-m (±30–kc deviation).
Number of tubes	17 (16 in unlettered model).

Intermediate frequencies:	
1st i.f. (intermediate frequency)	32.5 to 47.5 mc, variable.
2d i.f.	5 mc, fixed.
Frequency control	Each channel crystal-controlled by Crystal Unit CR-6B/U.
Crystal frequency range	7,300 to 8,741.7 kc.
Power input	100 watts at 115 volts ac, 50 to 60 cps.
Output impedance:	
High fidelity	500 ohms.
Speaker or headset	6 ohms.
Output level of high-fidelity line	0 dbm normal, +20 dbm maximum.
Audio response:	
High-fidelity channel	±1 db, 200 to 12,000 cps.
Speaker output	±1 db, 200 to 2,500 cps; −30 db, 3,000 cps and above.
Antenna	Half-wave dipole with director and reflector elements (supported by 40- or 50-foot mast) or v-h-f rhombic.
Weight (in Case CY-18 (*)/TRC-1 with running spares, tools, and operating components).	96 pounds.

6. Technical Characteristics of Amplifier AM-8(*)/TRA-1

Frequency range	70 to 100 mc.
Power output	200 watts, maximum.
Output impedance	50 to 100 ohms, into coaxial cable.
R-f input:	
R-f power necessary	25 watts, approximately.
Input impedance	70 ohms, approximately.
Number of tubes	5.
Power input:	
Ac	175 watts at 115 volts, 50 to 60 cps.
Dc (direct current) for bias	−100 volts.
Dc for plate supply	+1,900 volts at 250 ma (milliamperes).
Dc for screen supply	+450 volts at 40 ma.
Weight (in Case CY-15 (*)/TRA-1)	88 pounds.

7. Technical Characteristics of Power Supply PP-13(*)/TRA-1

Power output:	
Ac	175 watts at 115 volts, 50 to 60 cps.
Dc for bias	−100 volts.
Dc for plate supply	+1,900 volts at 250 ma.
Dc for screen supply	450 volts at 40 ma.
Power input	800 watts at 115 volts, 50 to 60 cps.
Number of tubes	3.
Weight (in Case CY-16 (*)/TRA-1).	194 pounds.

8. Technical Characteristics of Power Unit PE-75-(*)

Engine	Briggs and Stratton model ZZ or ZZL, 4-cycle, air-cooled.
Cylinders	1 (L head).
Piston:	
Bore	3 inches.
Stroke	3¼ inches.
Displacement	22.97 cubic inches.
Compression ratio	4.42 to 1.
Engine speed	2,200 to 3,200 rpm (revolutions per minute).
Horsepower	6 at 2,200 to 3,200 rpm.
Spark plug	Commercial 18 mm (millimeters) or Champion #5.
Fuel tank capacity	5 quarts on early models, 8 quarts on late models.
Crankcase oil capacity	4 pints.
Generator rating	2.5 kw (kilowatts) at 120 volts.
Power factor	100 percent.
Excitation	Self-excited.
Generator speed	1,800 rpm nominal, 1,850 rpm no load, 1,780 rpm full load.
Generator brushes	Carbon with pigtail, interchangeable on all models.
Exciter brushes	Carbon with pigtail, interchangeable on all models.
Weight:	
Unpacked	290 to 330 pounds.
Export packed, flexible barrier	491 pounds.
Export packed, sheet metal barrier	508 pounds.

9. Packaging Data

a. GENERAL. The contents of all packages are stenciled directly on the box. A packing slip in a moistureproof inclosure is stapled to each box and is protected by a supplementary covering patch. An orange band painted around the center of the box and a stripe painted across each end indicates packaging for export. Export packing is labeled "Packed with dehydrating agent. DO NOT OPEN UNTIL READY FOR USE." An orange spot means that the box is part of a shipment. One-slant-four (1/4) on a box is interpreted as "This is box No. 1 of four boxes required to complete one radio set." Items may be packaged in a manner different from that shown, depending on the supply channel.

b. TRANSMITTER AND RECEIVER. The transmitter is mounted in Case CY-17(*)/TRC-1

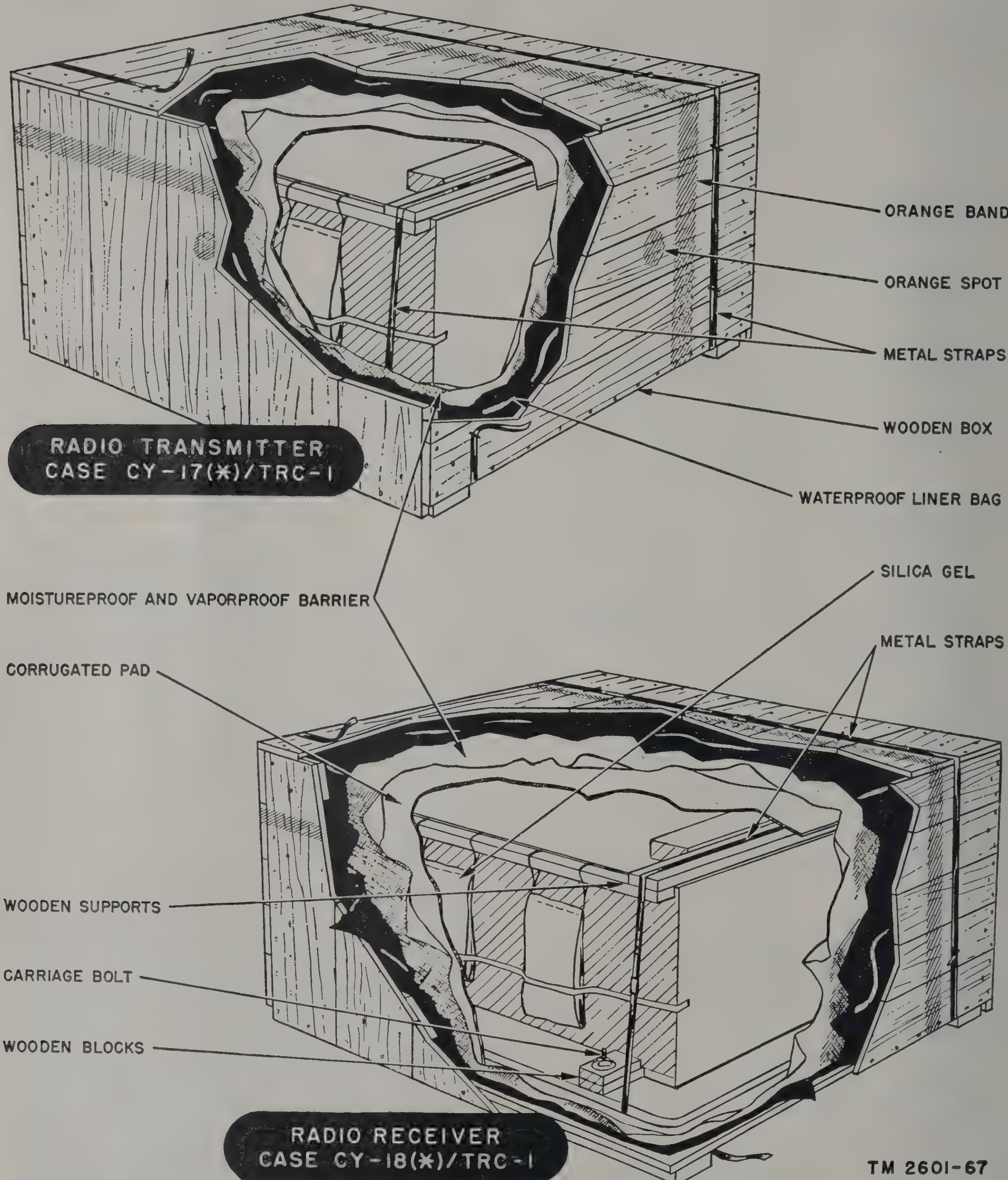


Figure 6. Packaging for Radio Transmitter T–14(*)/TRC–1 and Radio Receiver R–19(*)/TRC–1.

and the receiver in Case CY–18(*)/TRC–1. When packaged for export shipment, the cases are placed in moisture-vaporproof containers and are packed in wooden export crates. A cutaway view of the transmitter and the receiver packed for export is shown in figure 6. The

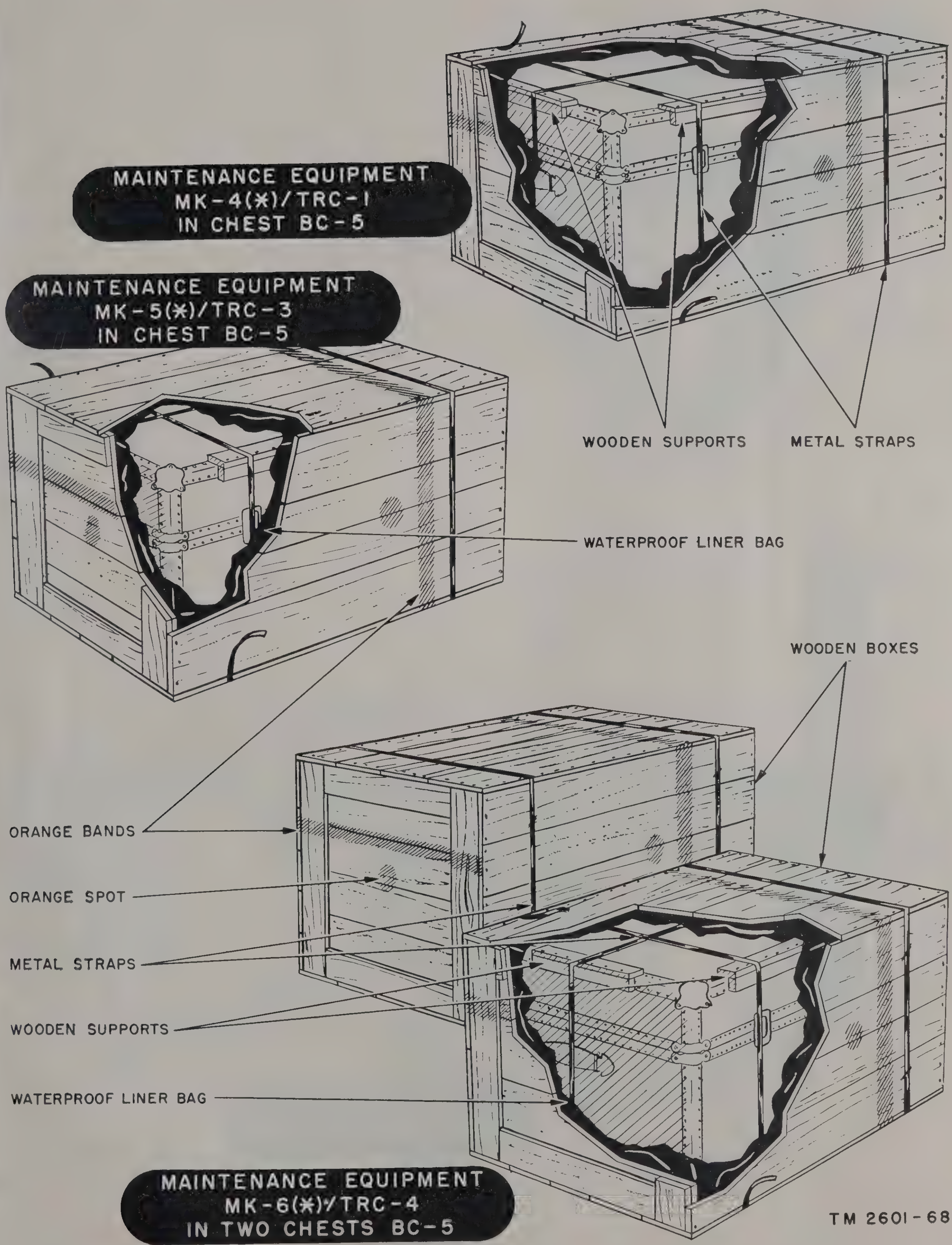


Figure 7. Packaging for Maintenance Equipments MK-4(*)/TRC-1, MK-5(*)/TRC-3, and MK-6(*)/TRC-4.

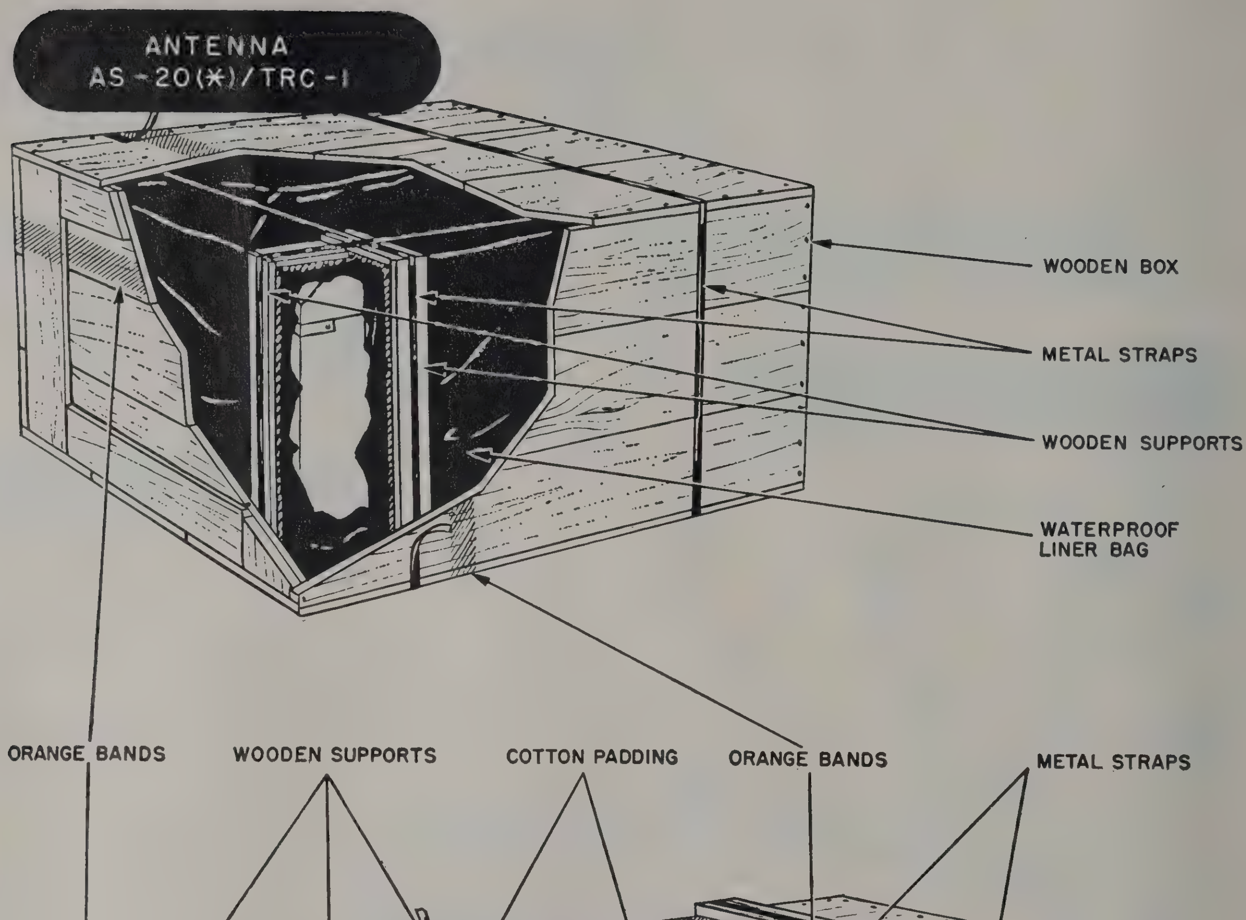


Figure 8. Packaging for Antenna System AS-19B/TRC-1.

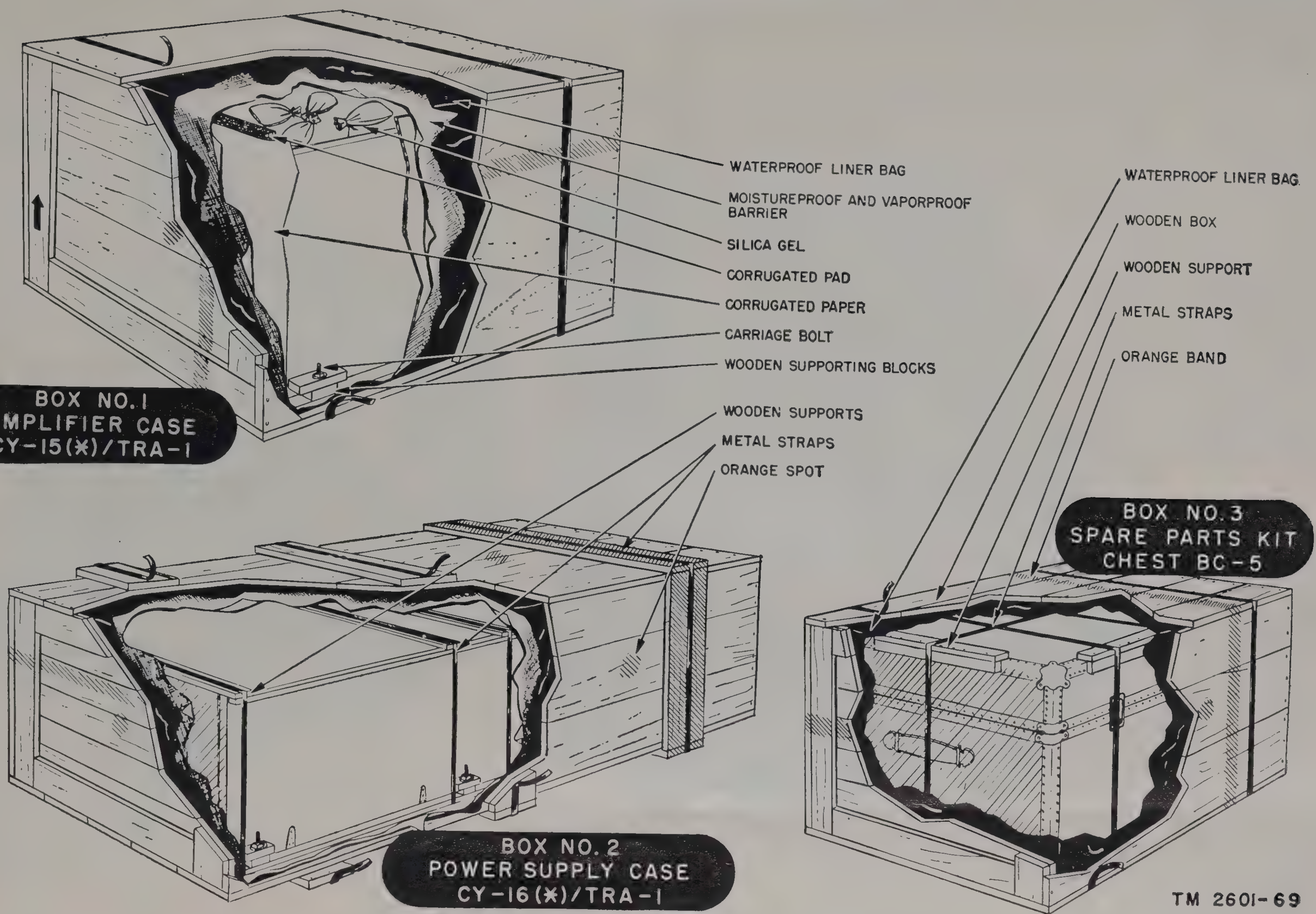


Figure 9. Packaging for Amplifier Equipment AN/TRA-1(*).

wooden crate sizes vary with the various models, whether the item is procured for use in continental United States or for use outside of the United States.

c. MAINTENANCE EQUIPMENT. Maintenance equipment is shipped in Chests BC–5 (fig. 7) or CY–64(*)/U, which, in turn, are packaged in wooden boxes. Maintenance Equipments MK–4(*)/TRC–1 and MK–5(*)/TRC–3 are packed individually in Chests BC–5 or Chests CY–

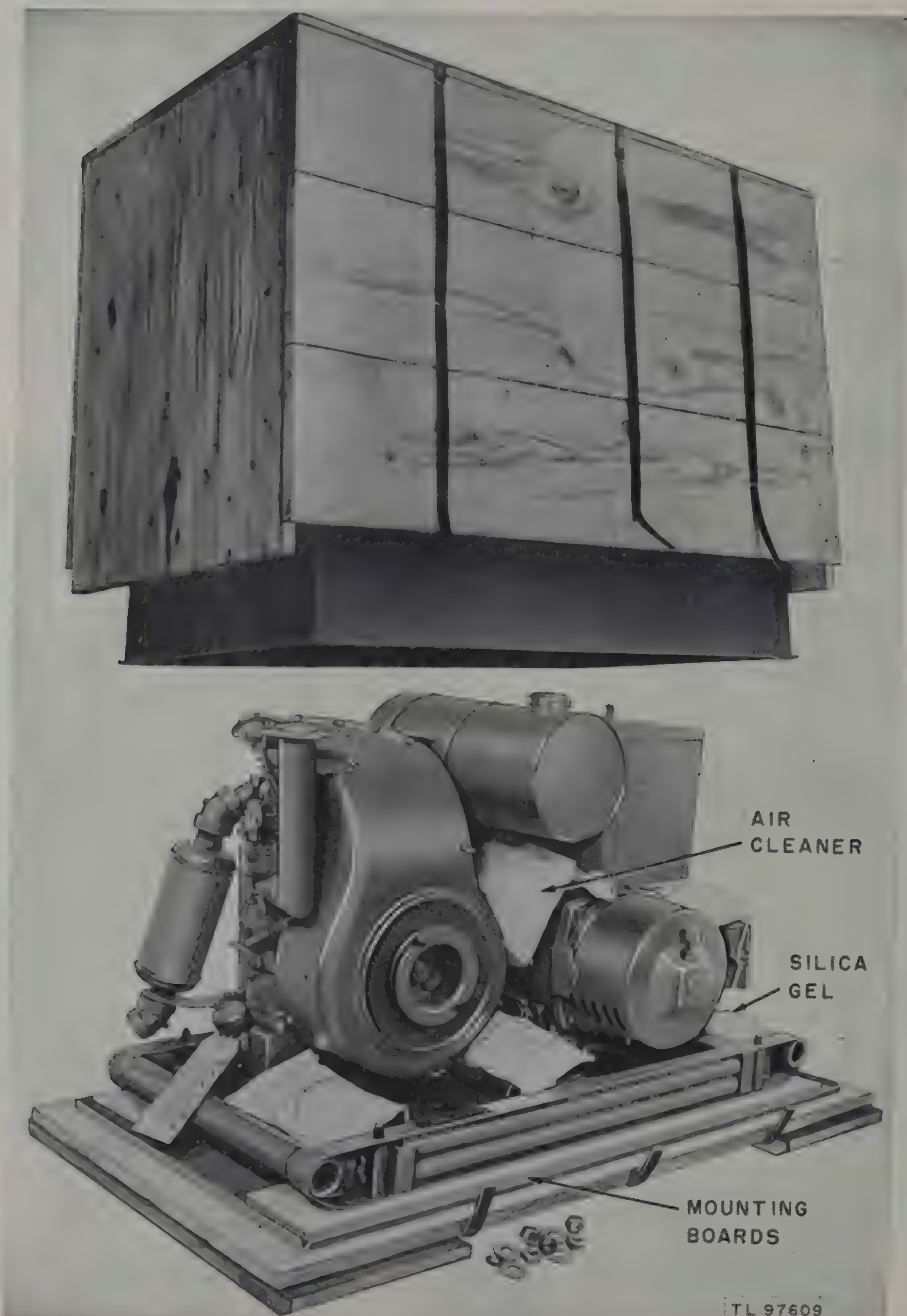


Figure 10. Power Unit PE–75–(*), packaging with rigid barrier.

64(*)/U. Maintenance Equipment MK–6(*)/TRC–4 usually is contained in two Chests BC–5. Late models of these radio equipments have Accessory Kits No. 1 and No. 2 or No. 1 through No. 3 in place of Maintenance Equipments MK–5(*)/TRC–3 and MK–6(*)/TRC–4. Accessory Kit No. 1 may replace Maintenance Equipment MK–4(*)/TRC–1.

d. Antenna System AS–19(*)/TRC–1. Early models of Antenna System AS–19(*)/TRC–1 were shipped in two wooden packaged cases, Cases CY–29(*)/TRC–1 and CY–30(*)/TRC–1 (fig. 8). Late models are packaged in two wooden shipping boxes. One box contains components of Antenna AS–20(*)/TRC–1 packed in Case CY–444/TRC–1 and Bag BG–102 or in Case CY–790/TRC–1. The second box contains Antenna Support AB–33(*)/TRC–1, packed in four cartons: one contains Carrying Frame CY–445/TRC–1 and a spare hammer handle, one contains another Bag BG–102(*), and the other two cartons each contain two Cases CY–443/TRC–1.

e. Amplifier Equipment AN/TRA–1(*). Amplifier Equipment AN/TRA–1(*) is shipped in three crates (fig. 9). Two of these crates contain Cases CY–15(*)/TRA–1 and CY–16(*)/TRA–1 and the third contains other components. The packaging and dehydrating agent may differ from that shown in figure 9.

f. Power Unit PE–75–(*). Two methods of packaging Power Unit PE–75–(*) for oversea shipment are used. Both are designed to give complete protection from moisture, vapor, and corrosion damage. The methods differ in the types of moistureproof and vaporproof barriers used; the flexible type and the sheet metal or rigid type. Figure 10 shows packaging with the sheet metal or rigid type of barrier.

g. Complete Systems. A complete 100-mile radio-relay system consists of two Radio Terminal Sets AN/TRC–3(*), three Radio Relay Sets AN/TRC–4(*), four Amplifier Equipments AN/TRA–1(*), three (one spare) Telephone Terminal Sets TC–21–(*), three (one spare) Telegraph Terminal Sets TC–22–(*), five (one spare) Ringer Sets TC–24–(*), and 15 miles of spiral-four cable packed for oversea shipment. This radio-relay system occupies 180 boxes, totaling 1,650 cubic feet, and weighs approximately 23 tons.

(1) Radio Set AN/TRC–1(*) weighs 1,435 pounds net and 2,000 pounds packed for export.
(2) Radio Terminal Set AN/TRC–3(*) weighs 2,560 pounds net and 3,150 pounds packed for export.
(3) Radio Relay Set AN/TRC–4(*) weighs 3,500 pounds net and 4,500 pounds packed for export.
(4) Amplifier Equipment AN/TRA–1(*) weighs 403 pounds net and 547 pounds packed for export.

10. Table of Components

Tables of the various components covered in this manual are given in appendix III. Refer to figures 2, 3, 4, and 5 and to paragraphs 3, and 11 through 32 for further assistance in the grouping and identification of components.

11. Description of Radio Transmitter T–14(*)/TRC–1

a. Radio Transmitter T–14(*)/TRC–1 (figs. 4, 11, and 35) is a crystal-controlled, 40-watt, f-m transmitter. It is capable of operation on any single frequency in the range of 70 to 100 mc and can be instantly switched to low power (10-watt) operation.

b. The transmitter utilizes the phase-shift method of obtaining the desired frequency deviation; this permits direct crystal control of the carrier frequency. The circuit is designed for a maximum frequency deviation of ±30 kc when modulated by 250- to 12,000-cycle audio. The transmitter is entirely self-contained and utilizes the tube types listed in table 1.

c. A meter and meter switch are located on the front panel of the transmitter to provide means of indicating current levels in the various stages. These readings facilitate circuit adjustments and maintenance.

d. A thermostatically-controlled fan circulates filtered air through the chassis when the chassis temperature exceeds approximately 75° to 85°F., making continuous operation practicable in hot climates.

e. Binding posts, feeding through lightning arresters, are provided for connection to spiral-four cable. R-F connections to the receiver and to the antenna are made through female coaxial

Table I. Tubes Used in Radio Transmitter T–14(*)/TRC–1

Circuit symbol	Type	Function	Applicable models
V1	6SN7GT	Crystal oscillator and audio amplifier.	All models.
V2	6AC7	Oscillator amplifier.	All models.
V3	6SL7GT	(1) Phase modulator.	All models.
		(2) First frequency doubler.	D, E.
		(2) VTVM (vacuum-tube voltmeter).	H.
V4	6AC7	Frequency tripler.	All models.
V5	6V6GT	Frequency quadrupler.	(U), A, B, C, H.
		Second frequency doubler	D, E.
V6	6V6GT	First frequency doubler.	(U), A, B, C, H.
		Third frequency doubler.	D, E.
V7	6V6GT	Second frequency doubler.	(U), A, B, C, H.
		Fourth frequency doubler.	D, E.
V8	6V6GT	Third frequency doubler.	(U), A, B, C, H.
		Fifth frequency doubler.	D, E.
V9	829B	Power amplifier.	All models.
V10, V11	816	Power rectifier.	(U).
V10, V11	5R4GY	Power rectifier.	A, B, C, D, E, H.

Note. (1) is the first half of tube; (2) is the second half of tube; and (U) is the unlettered model.

plugs. Waterproof Case CY–17(*)/TRC–1 allows emergency field operation in rainy weather.

12. Description of Radio Receiver R–19(*)/TRC–1

a. Radio Receiver R–19(*)/TRC–1 (figs. 12 and 36) is a single-channel crystal-controlled, double-conversion superheterodyne receiver designed for the reception of wide-band high-fidelity f-m signals of the type emitted by Radio Transmitter T–14(*)/TRC–1. The receiver has a total pass band of 250 to 12,000 cps.

b. The h-f (high-frequency) oscillator is crystal-controlled to insure stable reception during variations of temperature and humidity. The tubes used in the different models of Radio Receiver R–19(*)/TRC–1 are listed in table II.

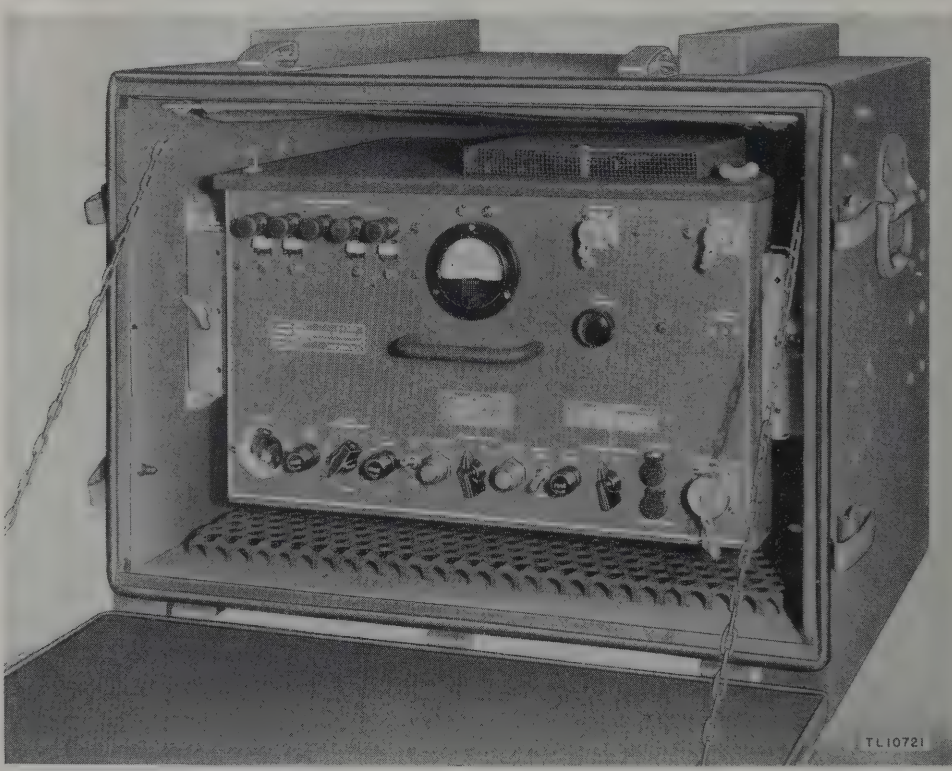


Figure 11. Radio Transmitter T–14/TRC–1 installed in Case CY–17/TRC–1.

Table II. Tubes Used in Radio Receiver R-19(*)/TRC-1

Ref. No.	Function	Model						
		Unlettered	A	B	C	D	E	H
V101	1st r-f amplifier	6AC7	6AC7	6AC7	6AC7	6AC7	6AC7	6AC7
V102	2d r-f amplifier	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V103	1st mixer	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V104	H-f, i-f amplifier	6AC7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V105	2d mixer	6SH7	6AC7	6AC7	6AC7	6AC7	6AC7	6AC7
V106	L-f (low-frequency) i-f amplifier.	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V107	1st limiter	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V108	2d limiter	6AC7	6AC7	6AC7	6AC7	6AC7	6AC7	6AC7
V109	Discriminator	6H6	6H6	6H6	6H6	6H6	6H6	6H6
V110	Squelch rectifier	6H6	6H6	6H6	6H6	6H6	6H6	6H6
V111	Crystal oscillator and multiplier.	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V112	Oscillator amplifier	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7	6SH7
V113	High-fidelity a-f (audio-frequency) output and carrier operated relay amplifier.	6SN7GT	6SN7GT	6SN7GT	6SN7GT	6SN7GT	6SN7GT	6SN7GT
V114	Speaker amplifier	6V6GT	6V6GT	6V6GT	6V6GT	6V6GT	6V6GT	6V6GT
V115	1st a-f amplifier and squelch	6SL7GT	6SL7GT	6SL7GT	6SL7GT	6SL7GT	6SL7GT	6SL7GT
V116	Power rectifier	6X5GT	6X5GT	6X5GT	6X5GT	6X5GT	6X5GT	6X5GT
V117	Power rectifier		6X5GT	6X5GT	6X5GT	6X5GT	6X5GT	6X5GT

c. A thermostatically controlled fan circulates filtered air through the chassis when the temperature exceeds 75° to 85°F., making continuous operation practicable in hot climates. Waterproof Case CY-18(*)/TRC-1 allows emergency operation in rainy weather.

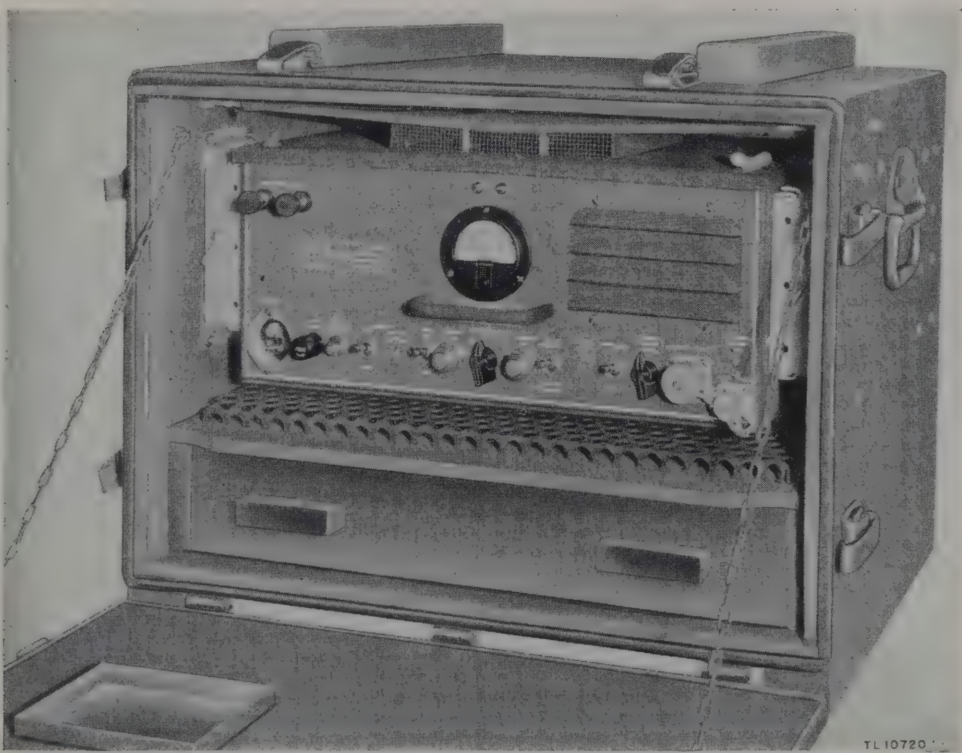


Figure 12. Radio Receiver R-19/TRC-1 installed in Case CY-18(*)/TRC-1.

d. A meter and a meter switch are provided on the front panel of the receiver for convenience in making circuit adjustments and in monitoring r-f and a-f circuit performance.

13. Description of Amplifier AM–8(*)/TRA–1

a. Amplifier AM–8(*)/TRA–1 (figs. 4, 13, and 37) is a push-pull, Class C, r-f amplifier designed to raise the maximum output power of Radio Transmitter T–14(*)/TRC–1 to 200 watts. This gain of 7 db may be sufficient to make a marginal circuit completely workable. Amplifier AM–8(*)/TRA–1 requires an external source of power for filament, bias, screen, and plate voltages. These voltages normally are supplied by Power Supply PP–13(*)/TRA–1.

b. Amplifier AM–8(*)/TRA–1 utilizes two 4E27 screen-grid power pentodes in a push-pull tuned-plate tuned-grid circuit. Due to the low internal plate-to-grid interelectrode capacitances of these tubes, no neutralization adjustments are required. Three OD3 voltage regulator tubes serve to regulate the screen voltage supply. A meter and a meter switch are provided on the front panel for reading grid and plate currents and plate voltage. These readings are used in making circuit adjustments and in monitoring the amplifier during operation.

c. A thermostatically controlled blower cools the equipment with filtered air when the chassis temperature exceeds approximately 75° to 85° F., permitting continuous operation in hot climates. Waterproof Case CY–15(*)/TRA–1 allows emergency operation in rainy weather.

d. In addition to the normal controls for the amplifier function, the operating controls for Power Supply PP–13(*)/TRA–1 also are located on the front panel of Amplifier AM–8(*)/TRA–1.

14. Description of Power Supply PP–13(*)/TRA–1

a. Power Supply PP–13(*)/TRA–1 (figs. 4, 14, and 38) is an a-c operated power supply designed to operate in conjunction with Amplifier AM–8(*)/TRA–1. It supplies the grid, filament, screen, and plate power required for the operation of the amplifier.

b. This power supply utilizes three rectifier

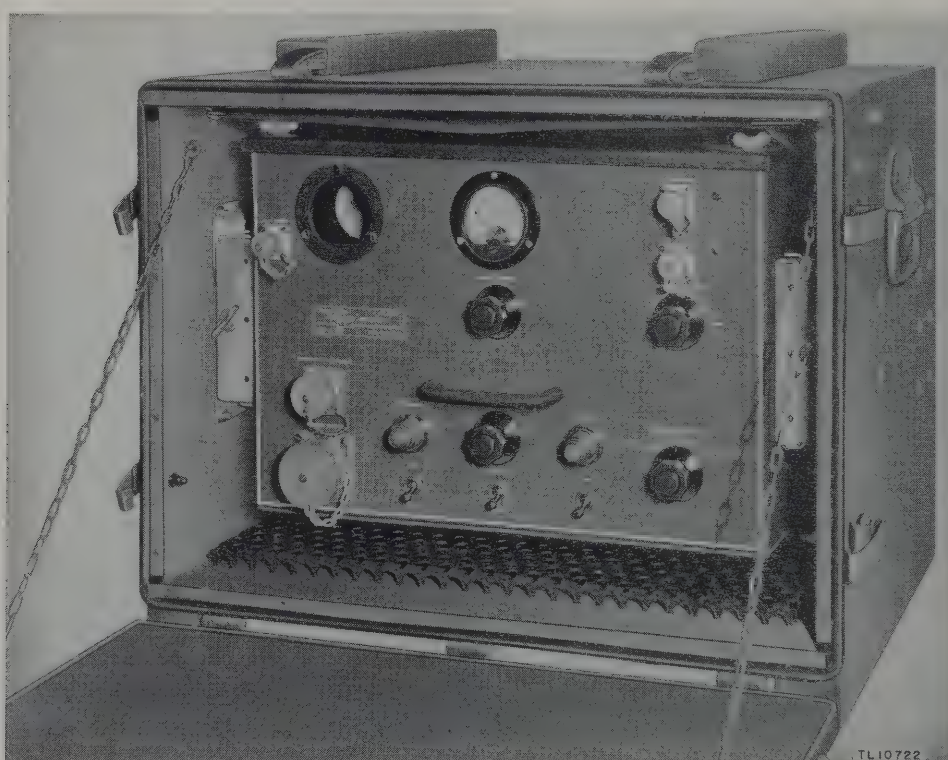


Figure 13. Amplifier AM–8/TRA–1 installed in Case CY–15(*)/TRA–1.

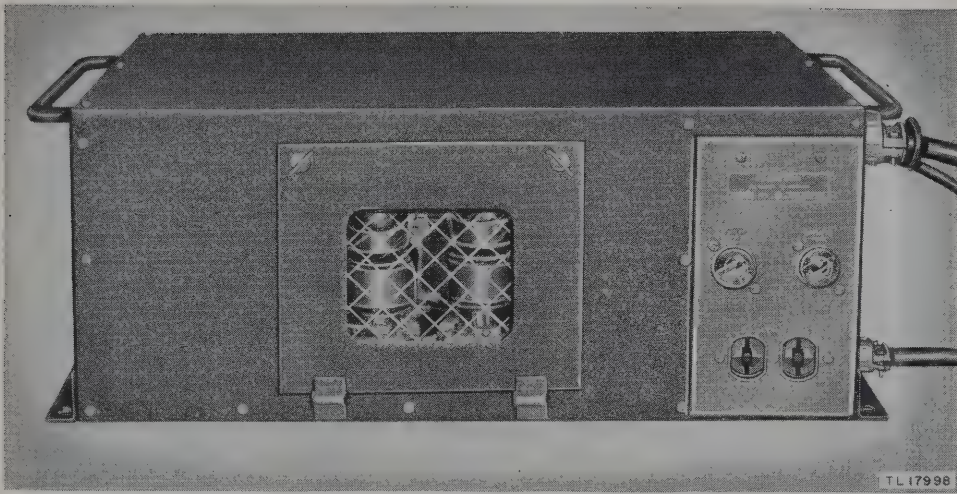


Figure 14. Power Supply PP–13B/TRA–1.

tubes to supply the required d-c voltages. Two tubes operate as a full-wave rectifier to furnish plate and screen voltages. These h-v (high-voltage) rectifiers may be type 866A (or 816) mercury-vapor tubes, high-vacuum 836 tubes, or gas-filled 3B28 types. A single 6X5GT full-wave rectifier furnishes bias voltage. External tube heaters were supplied with all models using mercury-vapor tubes except the unlettered model.

c. A thermostatically controlled blower cools the power supply with filtered air when the internal temperature exceeds approximately 75° to 85° F. Waterproof Case CY–16(*)/TRA–1 allows emergency operation in rainy weather.

d. Fuses are provided on the front panel for equipment protection and ease of replacement. Fused sockets providing 115-volt a-c power also are located on the front panel. These sockets may be used to supply the transmitter or for utility purposes.

15. Description of Power Unit PE–75–(*)

a. Power Unit PE–75–(*) (figs. 10, 15, and 84) is a self-contained, compact, portable, gasoline engine-driven generating set of the manual starting type. It is designed to deliver 2,500 watts of 60-cycle a-c power at 120 volts. These power units use Briggs and Stratton model ZZ or ZZL, single cylinder, air-cooled, 4-cycle gasoline engines for driving the generator. The engine is rated at 6 horsepower at 2,380 rpm.

b. The generator is a single-phase, 60-cycle, 120-volt, 1,800 rpm unit of the self-excited type. It is rated at 2.5 kw at 100 percent power factor and is coupled to the gas engine by dual V belts. Generator load connections are made in the outlet and filter box mounted on the generator frame (fig. 15).

c. The power unit is assembled on a skid base and has provisions for carrying. A tool and spare parts box is mounted on top of the generator frame. In an emergency, a maximum load of 3.08 kw can be drawn from the power unit. A variation of 50 rpm in the engine speed will result in a change of 1¼ cycles in the output.

16. Test Oscillator TS–32(*)/TRC–1

a. Test Oscillator TS–32(*)/TRC–1 (figs. 16 and 39) is designed to serve as a signal generator to facilitate tuning and adjustment of Radio Receiver R–19(*)/TRC–1. The test oscillator contains a crystal oscillator, frequency multiplier, audio oscillator, and a phase modulator. A three-tube circuit supplies all four functions. The crystal oscillator uses the transmitter crystals to generate a signal which is changed to the correct radio frequency by the frequency multiplier stage.

b. The r-f signal may be modulated with a 1,000-cycle note by means of the audio oscillator and phase modulator. The correct multiple of the crystal frequency is selected by the plate tuning control in the output circuit of the fre-

Figure 15. Power Unit PE–75–AD in use.

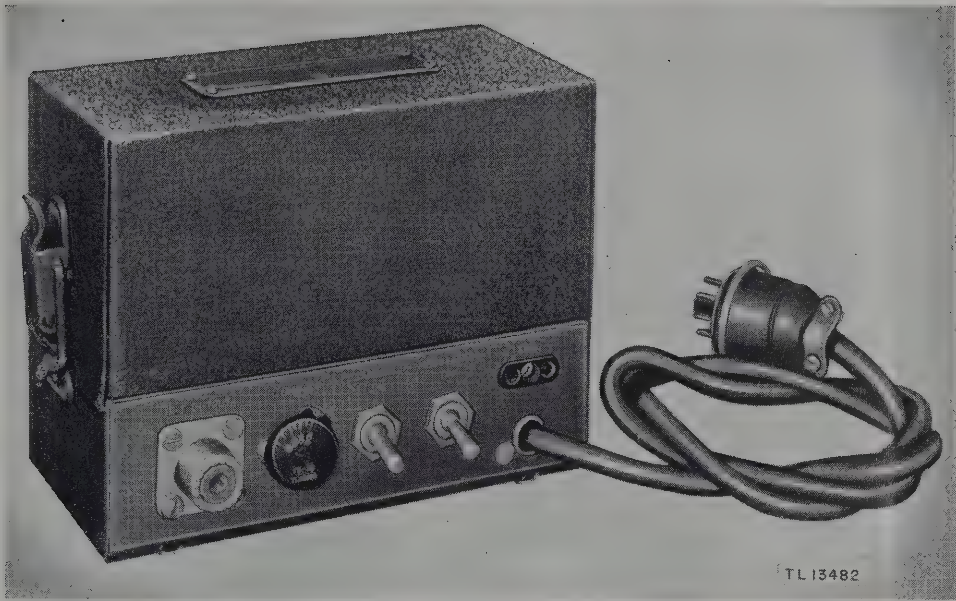


Figure 16. Test Oscillator TS–32A/TRC–1.

quency multiplier. The signal from the output terminal of the test oscillator is fed to the antenna connector of the receiver by 40-inch Cord CD–800 or CG–107/U. The r-f signal from the test oscillator has an amplitude of approximately 50 uv (microvolts).

c. The test oscillator derives all power for its operation from Radio Receiver R–19(*)/TRC–1. An extra vacuum-tube socket is provided on the receiver chassis to supply filament and plate power to the test oscillator, through a cord and plug that is permanently attached to the oscillator.

17. Antenna System AS–19(*)/TRC–1

a. Antenna System AS–19(*)/TRC–1 (figs. 5 and 17) contains all the equipment necessary to erect a v-h-f directional antenna array in the field for use with Radio Receiver R–19(*)/TRC–1 or Radio Transmitter T–14(*)/TRC–1. It includes the antenna array, mast, and coaxial transmission line with all installation equipment and aids. The unlettered through D models of the antenna system are packed in Cases CY–29(*)/TRC–1 and CY–30(*)/TRC–1. Models E and F are packed in Case CY–444/TRC–1, Carrying Frame CY–445/TRC–1, four Cases CY–443/TRC–1, and two Bags BG–102–(*) (fig. 17). (Case CY–790 may replace Case CY–444/TRC–1 and one Bag BC–102–(*).) Two Cases CY–443/TRC–1 are used together to form one package containing seven mast sections. Two such packages are used for each mast.

b. Antenna AS–20(*)/TRC–1, which is part of Antenna System AS–19(*)/TRC–1, is a directional array consisting of one driven half-wave dipole, one director, and one reflector. The spacing between the elements is .13 wavelength for the directors and .17 wavelength for the reflectors. All linear dimensions are readily adjustable without tools to tune the antenna to any frequency between 70 and 100 mc. All arrays are horizontally polarized except the late F model (figs. 40 and 57), which may be positioned for either horizontal or vertical polarization.

c. The unlettered and A models of Antenna Support AB–33(*)/TRC–1, part of Antenna System AS–19(*)/TRC–1, are 40 feet high; the supports can be extended to 50 feet by the addition of Antenna Extension Kit MX–141/TRC–1. The B and C models of the antenna support are approximately 50 feet high. In use, one Antenna AS–20(*)/TRC–1 is assembled to the top of the mast (antenna support).

18. Circuit Control Box C–21(*)/TRC–1

One Control Box C–21(*)/TRC–1 (figs. 18 and 85) is required at any duplex-repeater sta-

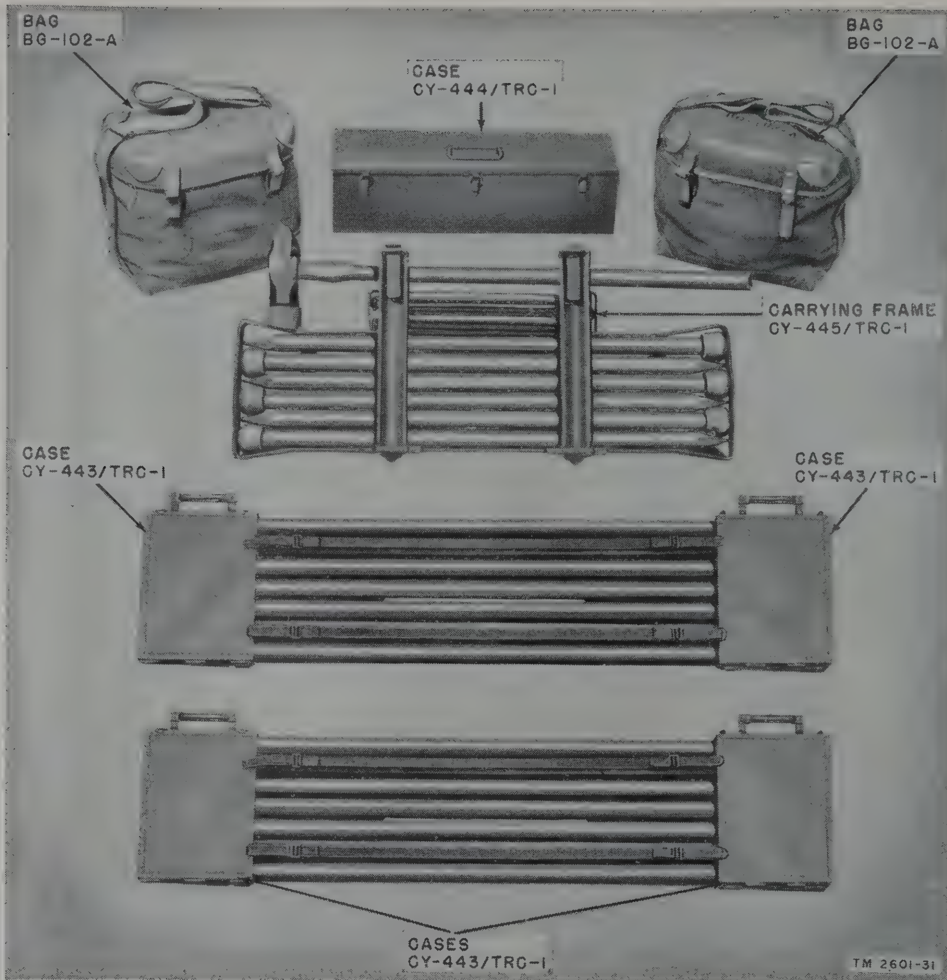


Figure 17. Antenna System AS-19E/TRC-1.

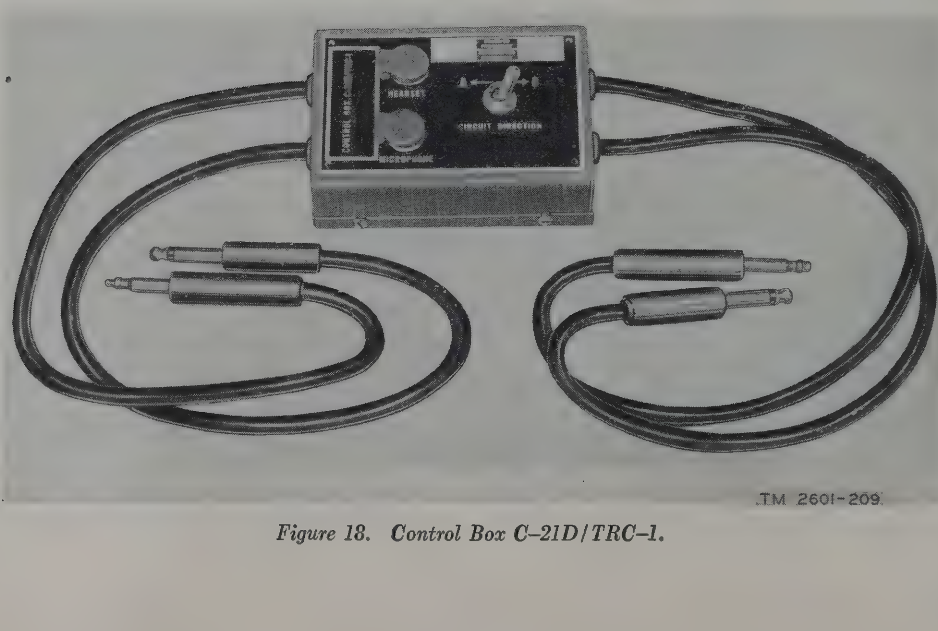


Figure 18. Control Box C-21D/TRC-1.

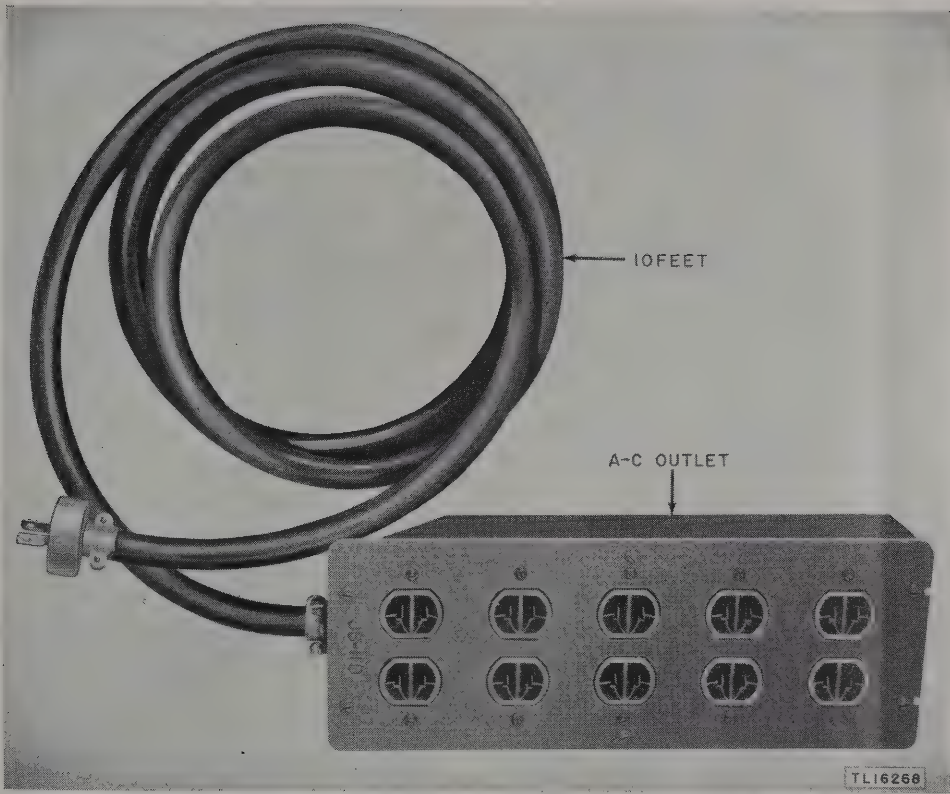


Figure 19. Junction Box JB–110.

tion to provide the local operator with facilities for talking in either direction at will on channel No. 1 of the equipments. This control box is furnished as part of Radio Relay Set AN/TRC–4(*). Two headset cords and two microphone cords plug into the jacks on the front panels of the two Radio Transmitters T–14(*)/TRC–1 in service. The operator's handset is plugged into the jacks provided on the circuit control box. Depending on the position of the CIRCUIT DIRECTION switch, the operator may talk with other operators in either direction on the circuit. Space is provided on the control box panel for recording, with a pencil, the channel frequencies involved.

19. Junction Box JB–110

Junction Box JB–110 (fig. 19) provides a means of connecting as many as 10 two-conductor power cords to a single power outlet. A 10-foot cord is provided to connect Junction Box JB–110 to the power source through Junction Box J–85/G. The transmitters, receivers, trouble lamps, and shelter lights may be plugged into Junction Box JB–110. Over-all dimensions are 12¼ inches long by 4½ inches wide by 2¼ inches deep.

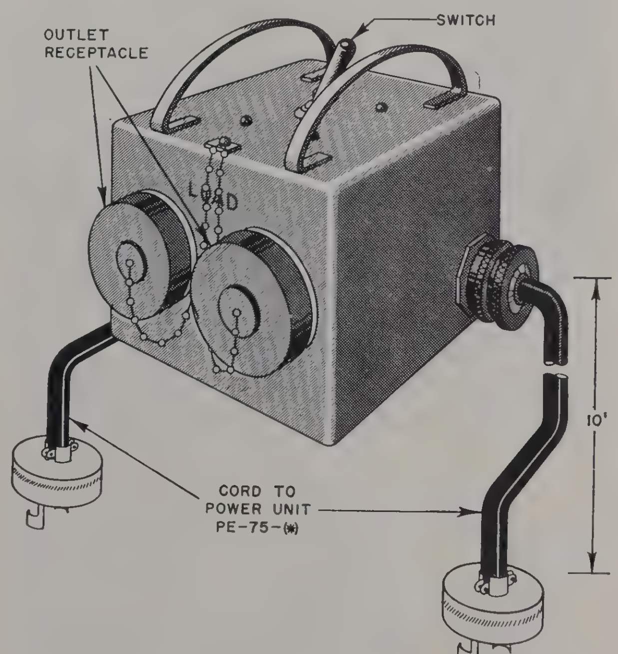


Figure 20. Junction Box J–85/G.

20. Junction Box J–85/G

Junction Box J–85/G (fig. 20) is used to facilitate the connecting of either one of two Power Units PE–75–(*) to an extension cord, to Junction Box JB–110, or directly to the load. A switch on the panel permits the selection of either power unit to be used. Two cords are provided; one fits into each power unit. Two paralleled output sockets are furnished for connection to the load, or to engage either the plug of Junction Box JB–110 or the 50-foot, two-conductor power extension Cord CD–711. A guard is provided for the switch to minimize the chance of accidentally switching the load to the other power unit.

21. Cases and Chests

a. CASE CY–17(*)/TRC–1. This is a waterproof plywood carrying case designed to house Radio Transmitter T–14(*)/TRC–1 when in transit or in field use (fig. 11). It is identical in external size and appearance to Cases CY–15(*)/TRA–1 and CY–18(*)/TRC–1 used to contain Amplifier AM–8(*)/TRA–1 and Radio Receiver R–19(*)/TRC–1, respectively. The case contains a shock-mounting rack into which the transmitter slides and locks. When the case is closed by means of the snap locks provided, a neoprene (a type of artificial rubber) gasket seals the case against the entrance of moisture. The front cover must be open under operating conditions; a canvas protective hood is provided for protection during inclement weather. A quantity of dehydrating agent is secured in this case to protect the equipment from the effects of moisture during shipment and storage.

b. CASE CY–18(*)/TRC–1.

(1) Case CY–18(*)/TRC–1 is a waterproof plywood carrying case designed to house Radio Receiver R–19(*)/TRC–1 when in transit or in field use (fig. 12). It is identical in external size and appearance to Cases CY–15(*)/TRA–1 and CY–17(*)/TRC–1 used for Amplifier AM–8(*)/TRA–1 and Radio Transmitter T–14(*)/TRC–1, respectively. This case contains a shock-mounting rack into which the receiver slides and locks. When the case is closed by means of the snap locks provided, a neoprene gasket seals the case against the entrance of moisture. The front cover must be open during operation and a canvas protective hood is provided for protection during inclement weather.

(2) A drawer is provided in the case below the receiver compartment. This drawer is designed to carry operating components and complete spare tube complements for both Radio Receiver R–19(*)/TRC–1 and Radio Transmitter T–14(*)/TRC–1, as well as spare fuses, pilot lamps, crystals, tools, and cordage (par. 32).

(3) To protect the equipment against humidity, a quantity of dehydrating agent is secured in the case. During shipment and initial storage, this chemical compound absorbs the moisture from the air which leaks past the neoprene gasketing.

c. CASE CY–15(*)/TRA–1. This is a waterproof plywood carrying case designed to house Amplifier AM–8(*)/TRA–1 when in transit or during field use (fig. 13). It is identical in all respects to Case CY–17(*)/TRC–1 and identical in external size and appearance to Case CY–18(*)/TRC–1.

d. CASE CY–16(*)/TRA–1.

(1) Case CY–16(*)/TRA–1 is a waterproof plywood case designed to house Power Supply PP–13(*)/TRA–1 when in transit or field use (fig. 4). The power supply is bolted directly to the case in its central compartment. Two additional compartments, one on each side of the power supply, provide room for spare tubes, pilot lamps, fuses, tools, and cordage for both Power Supply PP–13(*)/TRA–1 and Amplifier AM–8(*)/TRA–1.

(2) When the case is closed by means of the snap locks provided, a neoprene gasket seals the case against the entrance of moisture. The front cover must be open during operation, and some type of external rain shield should be provided.

e. CASE CY–29(*)/TRC–1. This case (fig. 5) is used to transport and store the component

parts of Antenna Support AB–33(*)/TRC–1 in the unlettered through D models of Antenna System AS–19(*)/TRC–1.

f. CASE CY–30(*)/TRC–1. This case (fig. 5) is used to transport and store the component parts of Antenna AS–20(*)/TRC–1 in the unlettered through D models of Antenna System AS–19(*)/TRC–1.

g. CHEST BC–5. This chest (fig. 7) contains various spare parts and maintenance items used in conjunction with the various equipments. Paragraphs 7 through 11 of appendix III list the contents of the various Chests BC–5.

h. CASE CY–443(*)/TRC–1. These are specially built units made to carry antenna mast sections used with the E and F models of Antenna System AS–19(*)/TRC–1. Two cases, fitted onto each end of seven mast sections and strapped together, form a package. Four cases CY–443(*)/TRC–1 are used with each antenna system, forming two packages containing fourteen mast sections (fig. 17).

i. CASE CY–444(*)/TRC–1. This case (figs. 17 and 40) contains the components of Antenna AS–20(*)/TRC–1 in the E and late F models of Antenna System AS–19(*)/TRC–1. The case is made of metal and has internal supports to hold the mast extensions and elements supports.

j. CARRYING FRAME CY–445(*)/TRC–1. This is a metal frame used to contain and carry six Stakes GP–108/U, five Stakes GP–2, and sledge Hammer HM–3. It is furnished with the E and F models of Antenna System AS–19(*)/TRC–1 (fig. 17).

k. BAGS BG–102–(*). These canvas bags are supplied with the E and F models of Antenna System AS–19(*)/TRC–1 to carry the small components of the antenna system. Carrying straps are attached to the bag. The bags have a height of 16 inches, a depth of 9 inches, and a length of 18 inches (fig. 17).

l. CASE CY–790(*)/TRC–1. This case was used in place of Case CY–444(*)/TRC–1 and one Bag BG–102–(*) in early procurements of Antenna System AS–19F/TRC–1.

m. CASE CY–67(*)/TRC–1. This is an olive drab finished steel case used to contain crystal units. It is 7⅛ inches long by 4⅝ inches wide by 2⅛ inches high and has the inside bottom lined with felt. The felt has holes punched in it to receive the crystal unit prongs. The case has a hinged and latched cover.

n. CASE CY–64(*)/U. This chest was supplied with the later G models in place of Chest BC–5 (*g* above) for containing spare parts. It is issued as part of accessory kit No. 1, No. 2, or No. 3.

22. Wire Dispenser MX–306A/G

a. This is an expendable, canvas and tape, drum shaped container in which Wire WD–1/TT is wound with a pretwist so that the wire returns to a nearly straight or flat-lying position after being payed out. It is issued with the G models of the terminal and relay sets. A non-water-soluble adhesive is applied to the wire coils during the winding process to keep the pretwisted wire in its coiled form until ready for use and as an aid in proper payout of wire. A 24-inch standing end pigtail is available for communication during payout and to permit splicing between coils for tandem operation. Three D-rings are provided at 90° intervals around the outside of the dispenser; these are used in mounting the dispenser on a packboard or other payout fixture.

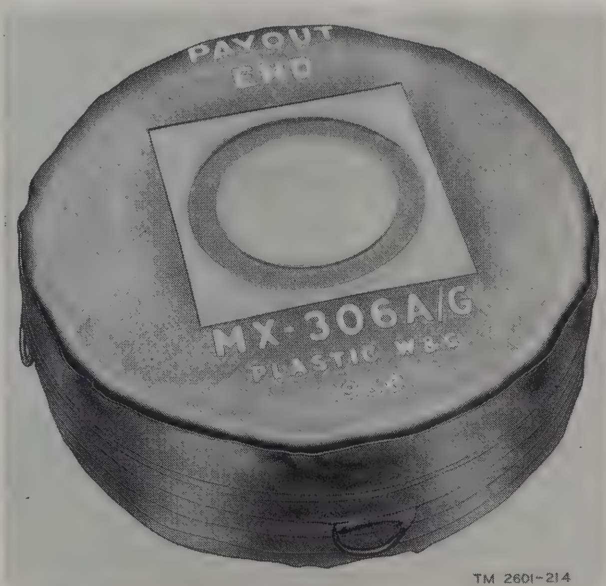


Figure 21. Wire Dispenser MX–306A/G.

b. Dispensers can be used one at a time or connected in tandem. Each unit contains one-half mile of Wire WD–1/TT. The wire can be used for any telephone line purposes with the relay or terminal sets.

23. Maintenance Equipment MK–4(*)/TRC–1

This equipment is furnished for limited maintenance of one Radio Set AN/TRC–1(*). The maintenance equipment is packed in one Chest BC–5 and is furnished only with the unlettered through E models of the radio set. It is replaced in the later models by accessory kit No. 1. A list of the component items is given in appendix III.

24. Maintenance Equipment MK–5(*)/TRC–3

This equipment is furnished for limited maintenance of one Radio Terminal Set AN/TRC–3(*). This maintenance equipment is packed in two Chests BC–5 and is furnished only with the unlettered through E models of the radio terminal set. It is replaced in the later models by accessory kit No. 2 or accessory kits No. 1 and No. 2. A list of the component items is given in appendix III.

25. Maintenance Equipment MK–6(*)/TRC–4

This equipment is furnished for limited maintenance of one Radio Relay Set AN/TRC–4(*). This maintenance equipment is packed in three Chests BC–5 and is furnished only with the unlettered through E models of the radio relay set. It is replaced in the later models by either accessory kits No. 1 and No. 2 or accessory kits No. 1, No. 2, and No. 3. A list of the component items is given in appendix III.

26. Accessory Kit No. 1

This kit is furnished for limited maintenance of one Radio Set AN/TRC–1(*). It is packed in one Chest BC–5 or CY–64(*)/U and is furnished with Radio Set AN/TRC–1G, Radio Terminal Set AN/TRC–3G, and Radio Relay Set AN/TRC–4G. Some procurements of this accessory kit also are used with Radio Set AN/TRC–8; a few parts used only with this latter

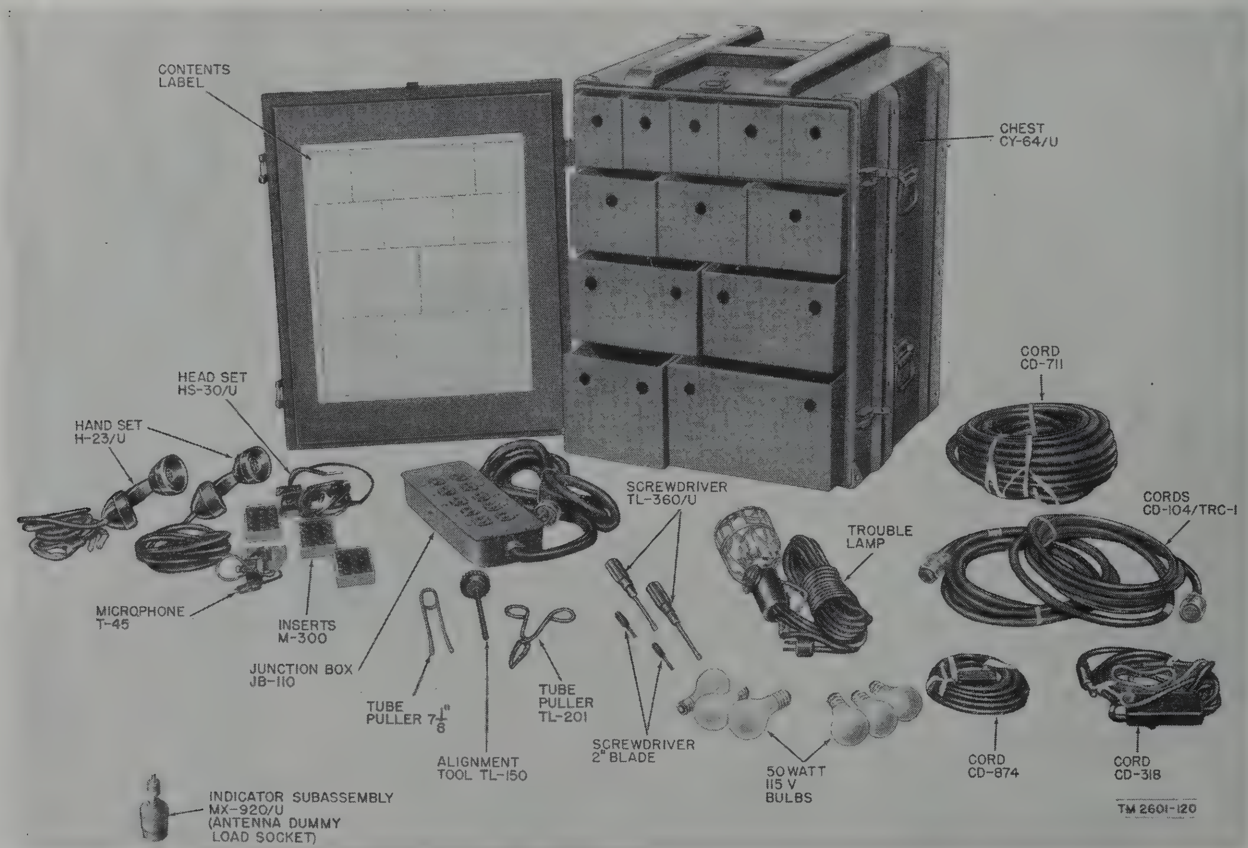


Figure 22. Accessory Kit No. 1 (late model) and contents.

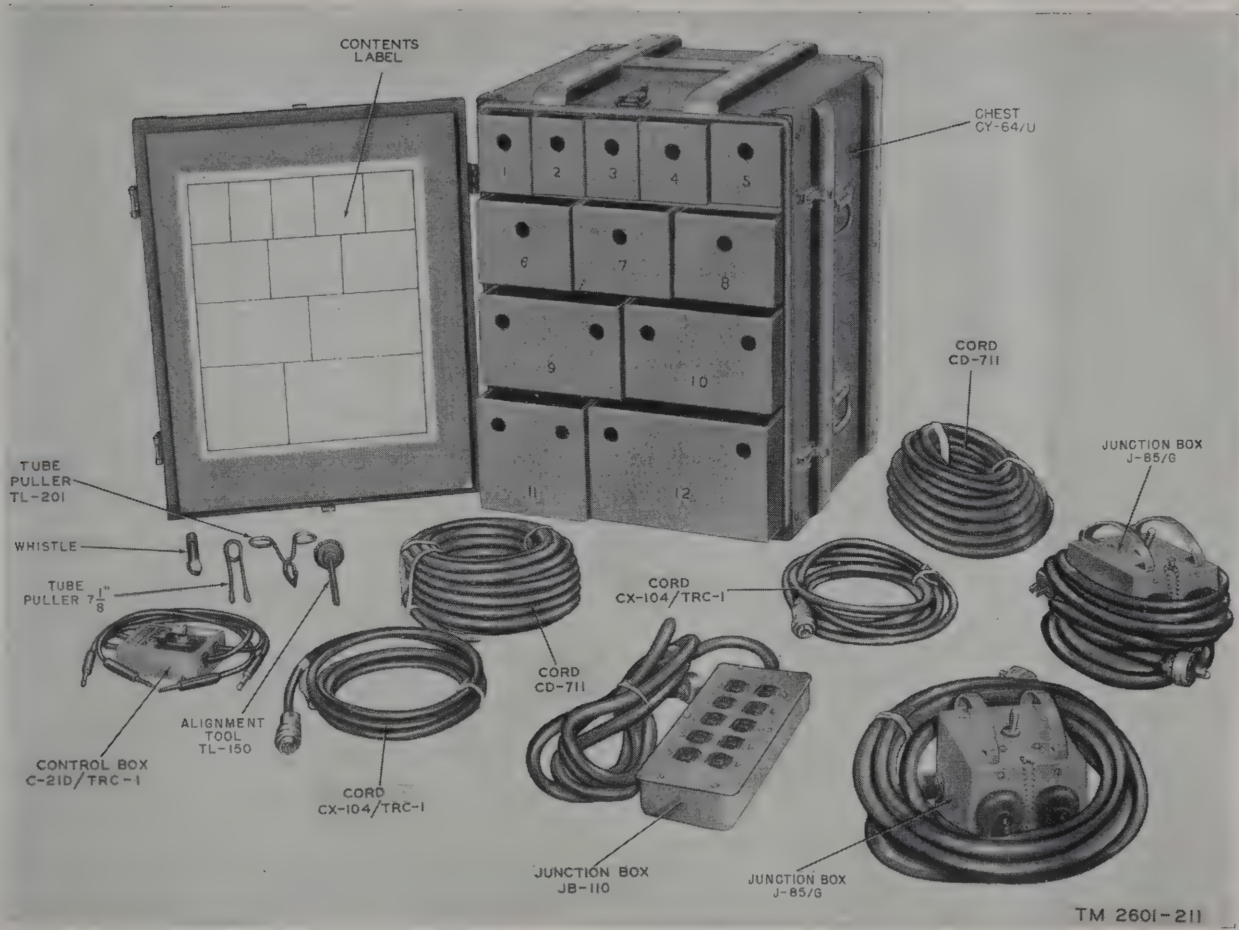


Figure 23. Accessory Kit No. 2 (late model) and contents.

set are included in the kit. Lists of component items of the two types of accessory kit No. 1 are given in appendix II.

27. Accessory Kit No. 2

This kit, together with accessory kit No. 1, is furnished for limited maintenance of one Radio Terminal Set AN/TRC–3G or one Radio Relay Set AN/TRC–4G. It is packed in one Chest BC–5 or CY–64(*)/U. Some procurements of this accessory kit also are used with Radio Terminal Set AN/TRC–11 and Radio Relay Set AN/TRC–12; a few parts used only with these latter two sets are included in the kit. For lists of components of the two types of accessory kits No. 2, see appendix II.

28. Accessory Kit No. 3

This kit, together with Accessory Kits No. 1 and No. 2, is furnished for limited maintenance of one Radio Relay Set AN/TRC–4G. It is packed in one Chest BC–5 or CY–64(*)/U and is furnished with early procurements of Radio Relay Set AN/TRC–4G. A list of the component items is given in appendix III.

29. Spare Parts Kit MK–11(*)/TRA–1

Spare Parts Kit MK–11(*)/TRA–1 is suitable for limited maintenance of one Amplifier Equipment AN/TRA–1(*), consisting of one Amplifier AM–8(*)/TRA–1 and one Power Supply PP–13(*)/TRA–1. It is packed in one Chest BC–5. A list of the component items is given in appendix III.

30. Cords

a. Cord CX–8/TRC–1. This is a 10-foot length of shielded five-conductor, rubber- or plastic-covered cable used to interconnect Radio Transmitter T–14/TRC–1 and Radio Receiver

R–19/TRC–1. It is fitted at each end with suitable connectors to make contact with the CONTROL CABLE receptacles on the front panels of the transmitter and receiver units. This cord is provided to interconnect the receiver high-fidelity output, handset monitoring, and carrier-operated control circuits. It is furnished only with sets that use unlettered models of the receiver and transmitter.

b. CORD CX–104/TRC–1. This is a 10-foot length of six-conductor cord used to interconnect Radio Transmitter T–14(*)/TRC–1 and Radio Receiver R–19(*)/TRC–1. It is fitted at each end with suitable connectors to make contact with the CONTROL CABLE receptacles on the front panels of the transmitter and receiver units. This cord is provided to interconnect the receiver high-fidelity output, handset monitoring, carrier-operated control, and audio-simplexing center-tapped circuits. It is furnished with sets that use the A through H models of the receiver and transmitter.

c. CORDS CD–800 and CG–107/U. These cords consist of a flexible r-f transmission line having a characteristic impedance of 52 ohms. They are made up of Cable WC–549 or Radio Frequency Cable RG–8/U and are fitted at each end with Plug PL–259–(*).

(1) *Cord CD–800 or CG–107/U (40-inch).* One of these cords is packed in the drawer of Case CY–18(*)/TRC–1 and is furnished as an operating component for interconnecting the antenna circuits of the receiver and transmitter (or amplifier) when a common antenna is used. Additional cords are used for coupling Test Oscillator TS–32(*)/TRC–1 to the receiver during alinement procedures and for coupling Radio Transmitter T–14(*)/TRC–1 to Amplifier AM–8(*)/TRA–1. Cord CD–800 (40-inch) is furnished with sets using the unlettered through E models of the receiver and transmitter. Cord CG–107/U (40-inch) is furnished with sets using the H model of the receiver and transmitter.

(2) *Cord CD–800 or CG–107/U (50 foot).* These cords are furnished as part of Antenna System AS–19(*)/TRC–1 for the purpose of connecting Antenna AS–20(*)/TRC–1 to the radio set. The 50-foot length of coaxial transmission line is part of the unlettered through E models of Antenna System AS–19(*)/TRC–1.

(3) *Cord CD–800 or CG–107/U (15 ft 6 in).* These lengths of transmission line are used to make up the required total length from the antenna to the set or when Antenna AS–20(*)/TRC–1 is mounted comparatively close to the receiving and transmitting equipment. This length of coaxial cable is furnished with the D through F models of Antenna System AS–19(*)/TRC–1.

(4) *Cord CD–800 or CG–107/U (35-foot).* This length of coaxial cable is used for the same purposes as the 15½-foot length described in (3) above. It is furnished only with the F model of Antenna System AS–19(*)/TRC–1.

(5) *Cord CD–800 or CG–107/U (65-foot).* This length of coaxial cable is used with the 50-foot height of Antenna Support AB–33(*)/TRC–1. However, it is furnished only with the F model of Antenna System AS–19(*)/TRC–1, so two or more shorter lengths may be used to form the r-f transmission line when the total antenna height is greater than 40 feet in the unlettered through F models of the antenna system.

d. CORD CD–711. This is a 50-foot 2-conductor rubber-covered power extension cord used between Power Unit PE–75–(*) and Junction Box JB–110, or, when two power units are used, between Junction Boxes J–85/G and JB–110. The ends are terminated in an appropriate male plug and female receptacle.

e. CORD CD–318–(*) (fig. 24). This is a microphone extension cord for use with Microphones T–30–(*) or T–45. The cord is equipped with a switch (Switch SW–141–(*)) and is suspended from the wearer's neck with either a cord or a strap with a quick release clip. The Terminals at one end of the switch are con-

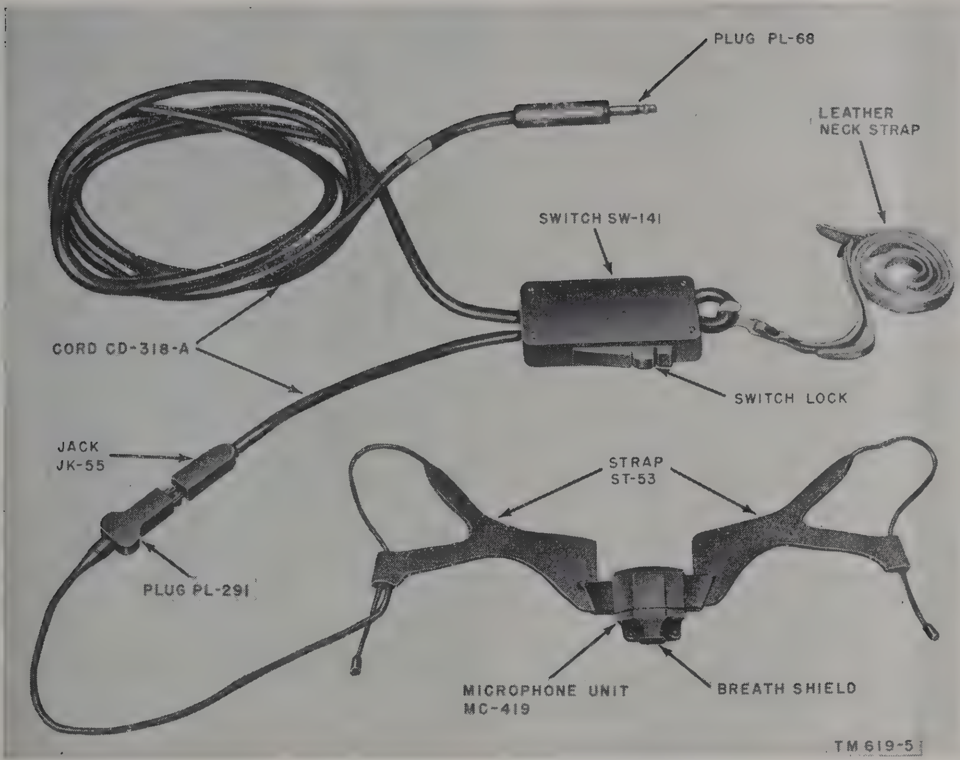


Figure 24. Microphone T–45 and Cord CD–318–A.

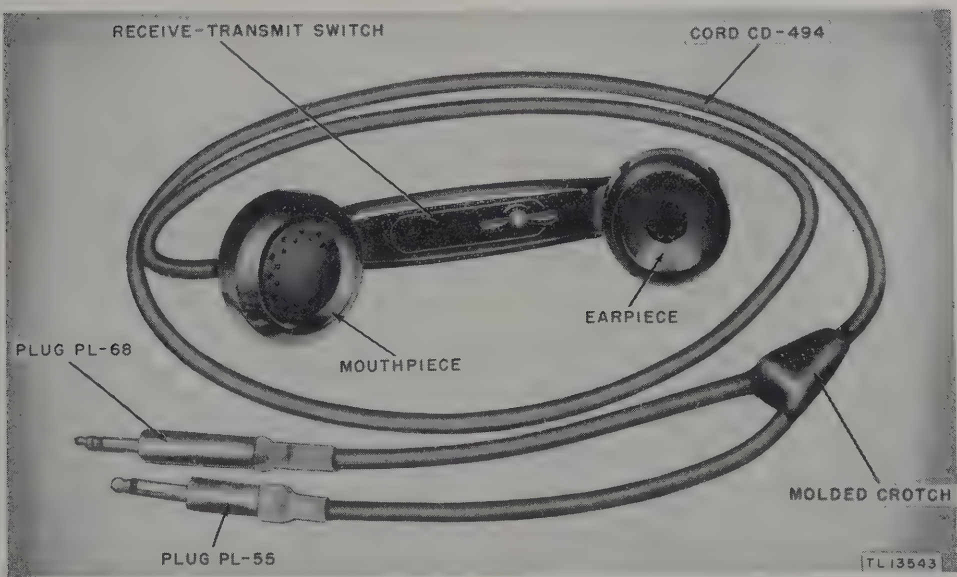


Figure 25. Handset H–23(*)/U.

nected to 7 feet of Cordage CO–122–A (or Cordage CO–145) and the terminals at the other end of the switch are connected to 8 inches of Cordage CO–199–B. The 7-foot length of cord terminates in a Plug PL–68–(*), which plugs into the radio set. The 8-inch length of cord terminates in Jack JK–55, into which the microphone is plugged.

f. Cord CD–874 (fig. 26). This is a 6½-foot headset extension cord used with (but not part of) Headset HS–30–(*). It terminates in Plug PL–55 at one end and in Junction Box JB–47 (to receive the headset lead terminals) at the other end.

31. Minor Components

a. Handset H–23(*)/U (fig. 25). This is a formed plastic handset containing a single-button carbon microphone at the connection cord end. The earpiece and the microphone are connected to Plugs PL–55 and PL–68, respectively. The microphone is connected into the circuit by operating the receive-transmit push-to-talk switch. This handset normally is used by the radio set operator for all normal communications. Instead of Handset H–23(*)/U, Handset TS–13–(*) was issued with the unlettered models and Handset TS–15–(*) was issued with the A models of these equipments. All three types are similar.

Figure 27. Telephone EE–8–B.

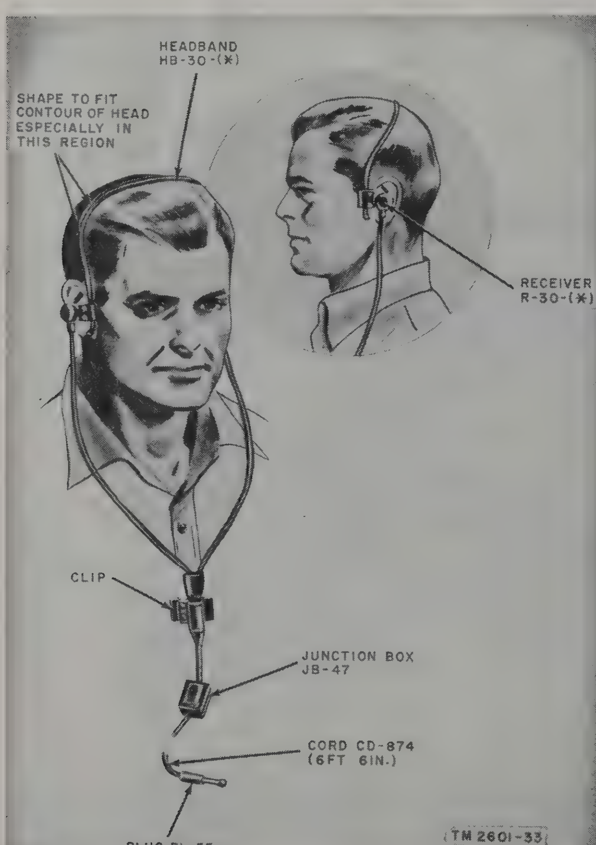


Figure 26. Headset HS–30–(*) and Cord CD–874 in use.

b. Headset HS–30–(*) (fig. 26). Headset HS–30–(*) is lightweight and closely fits the operator's head. It has special soft rubber earpieces, which snap on the receivers of the headset and fit snugly into the ear cavities of the operator. These earpieces exclude outside noises, thus aiding in the hearing of weak signals. The head band is of thin steel which is adjustable to the contours of the operator's head. The clip on the headset cord is attached to the operator's clothing to relieve the pull of the headset extension cord.

c. Microphone T–45(*) (fig. 24). Microphone T–45–(*) is a noise-canceling, single-button, carbon microphone designed to be worn over the upper lip. The design of the microphone reduces background noise and allows speech to be reproduced clearly under all conditions of loud background noise. This microphone is used with Cord CD–318–(*), containing a press-to-talk switch, which is used as the receive-transmit switch in a manner similar to the push-to-talk switch on the center part of Handset H–23(*)/U.

d. Telephone EE–8–(*) (fig. 27). Telephone EE–8–(*) is a portable field telephone designed for use on either local or common bat-

tery field telephone systems. It is rugged and compact, and its performance equals that of modern commercial telephones. A talking range of 11 to 18 miles may be expected on Wire W–110–B or WD–1/TT, depending on weather conditions and the type of construction of the wire line. Two Batteries BA–30 are required to operate the telephone on local battery systems. This telephone may have either a canvas or leather carrying case. See TM 11–333 for complete information on Telephone EE–8–(*). The telephones are issued as part of Radio Terminal Sets AN/TRC–3(*) and Radio Relay Sets AN/TRC–4(*) only.

e. TEST SET I–56–K (fig. 28). This test set is issued with Radio Terminal Sets AN/TRC–3 through AN/TRC–3E and with Radio Relay Sets AN/TRC–4 through AN/TRC–4E. Test Set I–56–K consists of Voltohmmeter I–166, Test Unit I–176, and Tube Tester I–177, complete with test leads and Carrying Case CS–130. The components of this test set are used to make resistance and voltage measurements and to check the vacuum tubes used in the electrical circuits of the radio sets. Detailed description and information on the use of Test Set I–56–K is found in the three technical manuals furnished with the equipment:

Figure 28. Test Set I–56–K in carrying case.

(1) TM 11–2613, Voltohmmeter I–166.

(2) TM 11–2626, Test Unit I–176.

(3) TM 11–2627, Tube Tester I–177.

f. MULTIMETER TS–297/U (fig. 29). Multimeter TS–297/U is a multi-range test instrument for measuring a-c and d-c voltages (six ranges, up to 1,000 volts), direct current (four ranges, up to 400 ma), and resistance (three ranges, up to 100,000 ohms). With the addition of a capacitor, it also may be used as an output meter on the a-c voltage ranges. This multimeter is packed with early procurements of Radio Terminal Set AN/TRC–3G and Radio Relay Set AN/TRC–4G. Cords and clips are included with the multimeter, including a special cord terminated in a standard headset type plug. For full information on this unit, refer to TM 11–5500.

g. MULTIMETER TS–352/U (fig. 30). This portable unit is issued with late procurements of Radio Terminal Set AN/TRC–3G and Radio Relay Set AN/TRC–4G. It is battery operated. For full information on this unit, refer to TM 11–5527. The following ranges are available:

(1) A-c and d-c voltage ranges: 0 to 2.5/10/50/250/500/1,000 at 1,000 ohms per volt.

(2) D-c voltage ranges: 0 to 2.5/10/50/250/500/1,000/5,000 at 20,000 ohms per volt.

(3) D-c current ranges: 0 to 250 ua (microamperes), 0 to 2.5/10/50/100/500 ma, 0 to 2.5/10 amperes.

(4) D-c resistance ranges: 0 to 300/30,000/300,000 ohms, 0 to $\frac{3}{30}$ megohms.

h. TUBE TESTER I–177 (fig. 31). This is an instrument used to test and measure mutual conductance values of vacuum tubes. It is issued with Radio Terminal Set AN/TRC–3G and Radio Relay Set AN/TRC–4G, separately, and with Radio Terminal Sets AN/TRC–3 through AN/TRC–3E and Radio Relay Sets AN/TRC–4 through AN/TRC–4E as part of Test Set I–56–K (*e* above). This tube tester is of the dynamic mutual conductance type and provides either REPLACE—GOOD readings or mutual conductance values in microhms for Signal Corps and commercial receiving tubes and small transmitting tubes. It will check all tubes used with

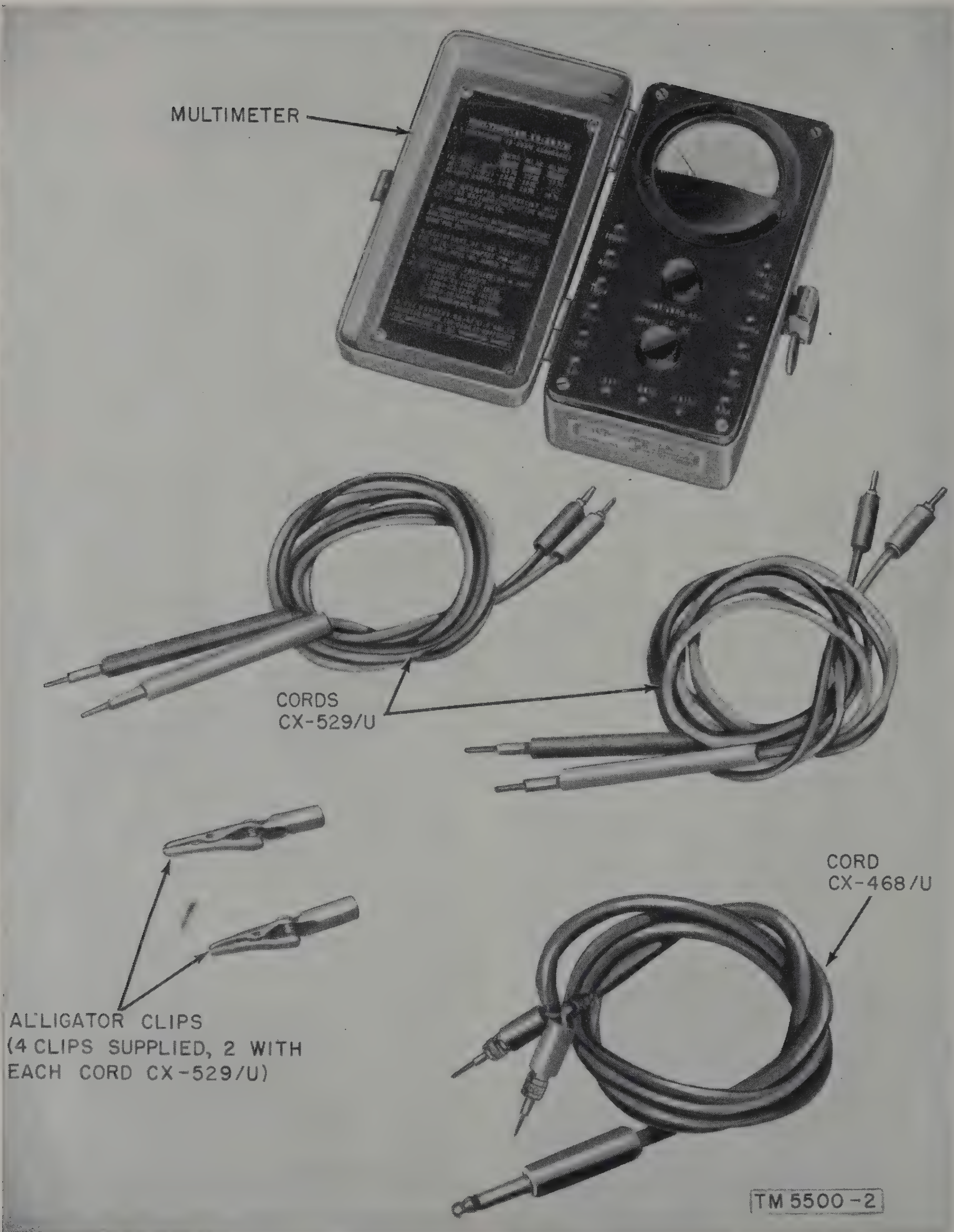


Figure 29. Multimeter TS–297/U components.

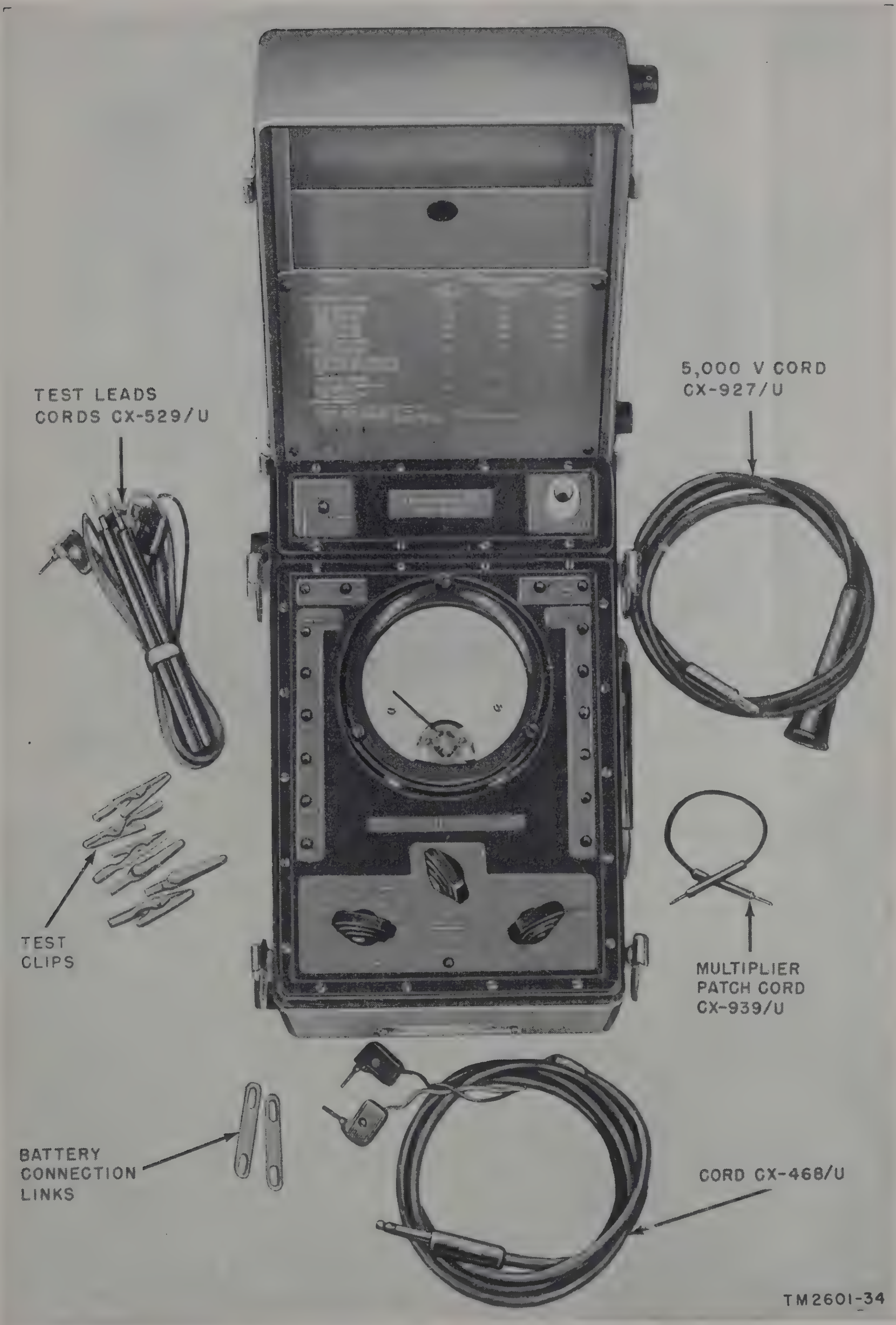


Figure 30. Multimeter TS–352/U.

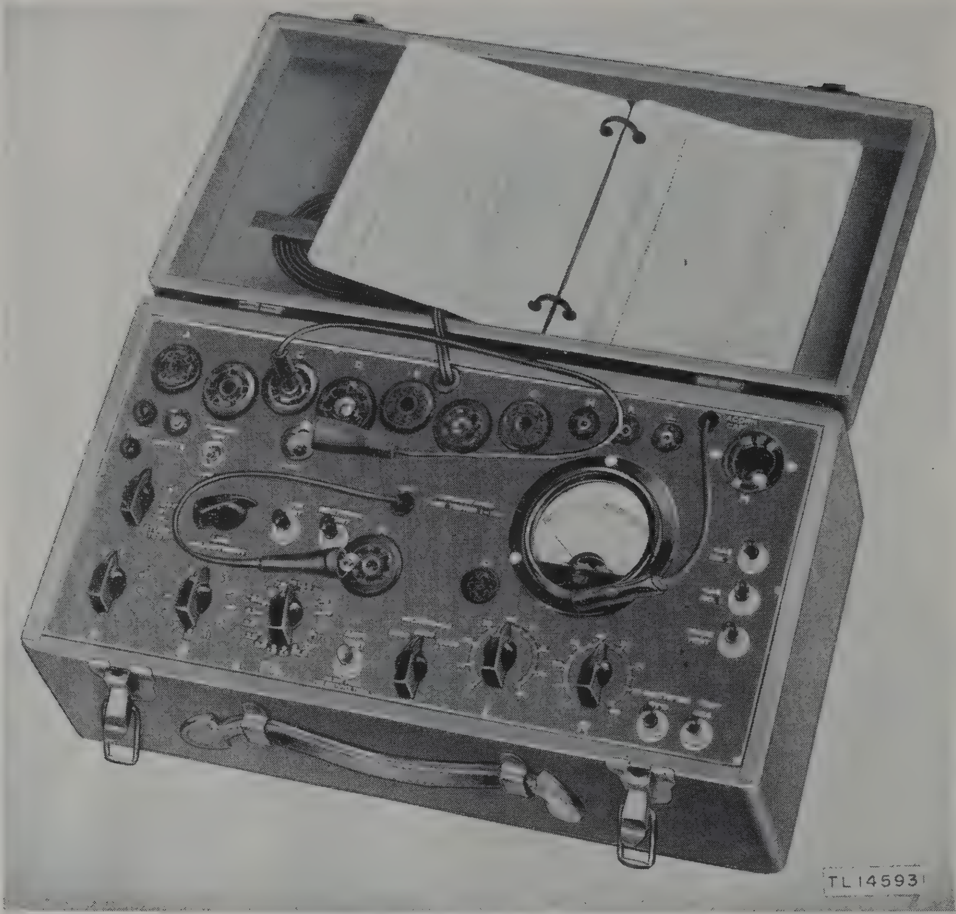


Figure 31. Tube Tester I–177 with cover raised.

the radio equipments covered in this technical manual except the 829B tubes in the transmitter and the 4E27 tubes in Amplifier AM–8(*)/TRA–1. Special switches are provided for making gas tests of tubes. Noise test can be made by connecting the input of a radio receiver to two NOISE TEST jacks.

i. LIGHTNING ARRESTORS (fig. 32). Four carbon-block type lightning arrestors are provided on the front panel of Radio Transmitter T–14(*)/TRC–1 (figs. 11 and 35) for protection against lightning discharge voltages induced in the spiral-four cable (*j* below). Each arrestor consists of two units: a solid carbon block mounted to the ground side of the holder; and a ceramic frame, containing a carbon plug which is held in place with low-temperature fusing cement (fig. 32). When these two blocks are mounted together, the small air gap between them protects against all voltages likely to be encountered. Ordinarily, lightning discharge impulses induced into the spiral-four cable will cause an arc across the air gap between the carbon block and the carbon plug, but will not generate enough heat to melt the cement holding the carbon plug in place. A short circuit between the spiral-four cable and a power line, however, will cause repeated arcs of sufficient duration to heat the carbon plug and melt the cement holding the plug in place. The mounting spring will push the carbon plug into direct contact with the solid carbon plug and permanently ground the line.

j. SPIRAL-FOUR CABLE.

(1) This was designed as a transmission line for Telephone Terminal CF–1–(*). Cable Assembly CC–358–(*) is a ¼-mile length of four conductors, rubber insulated, spirally twisted, and covered with a shielding tape of me-

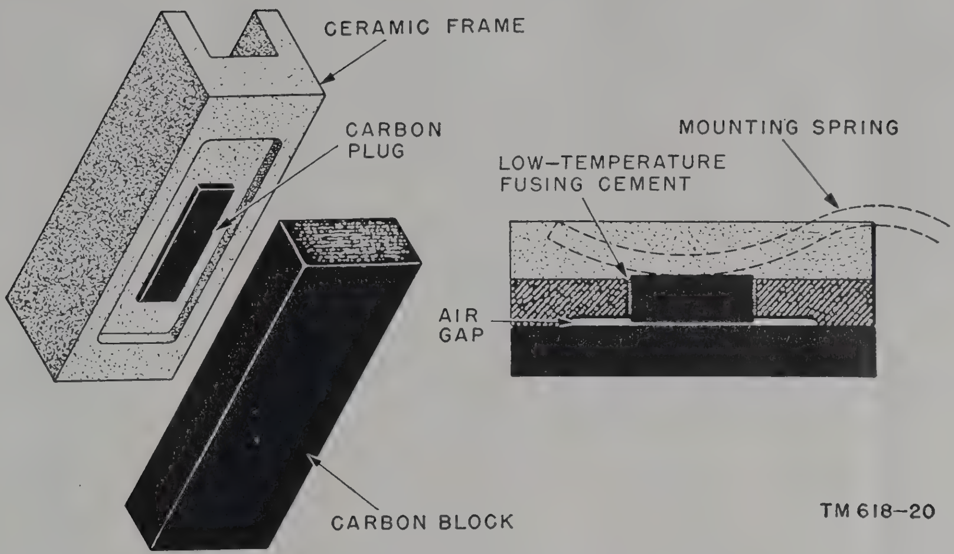


Figure 32. Carbon-block type of lightning arrestor.

tallized paper, which, in turn, is covered with a served paper wrapping. Over the paper wrapping there is a steel wire braid to give mechanical strength; the outside cover of the cable is a heavy rubber jacket. Cable Assembly CC–358–(*) is terminated at both ends in specially designed connectors which include loading coils, molded inside the rubber jacket. When two connectors are plugged together, the circuits are connected between the two cable lengths and all wires are loaded.

(2) Cable Assembly CC–358–(*) will make up the line between Telephone Terminal CF–1–(*) and the radio terminal station. Its physical appearance, except for length, is identical with that of Cable Assembly CC–368–(*) which is shown in figure 34. Cable Assemblies CC–358–(*) are supplied with the radio equipments.

k. Cable Stub CC–356–(*). Cable Stub CC–356–(*) is used to connect the spiral-four cable to a transmitter at the radio terminal station or to a v-f (voice-frequency) carrier bay at the telephone or telegraph terminal. The stub consists of 12 feet of 4-wire, rubber-insulated, rubber-jacketed Cable WC–548 with a coupler at one end (fig. 33). One of the two wire pairs is colored and connects through a loading coil in the coupler to the female terminals. The other pair is white and connects directly to the male terminals of the coupler. At the stub end the conductors are exposed to permit connection to binding posts. A fifth distinctively colored wire is connected to the shield of the cable and brought out at the free end of the cable stub. This is connected to a ground terminal on the equipment. Cable Stub CC–356–(*) furnishes a means of terminating Cable Assembly CC–358–(*) so that it can be connected to terminals or equipment without having to cut and strip the rubber jacket at the end of the cable assembly.

l. Cable Assembly CC–368–(*). This assembly (fig. 34) consists of 100 feet of spiral-four cable with couplers at both ends. It has

Figure 33. Cable Stub CC–356–S.

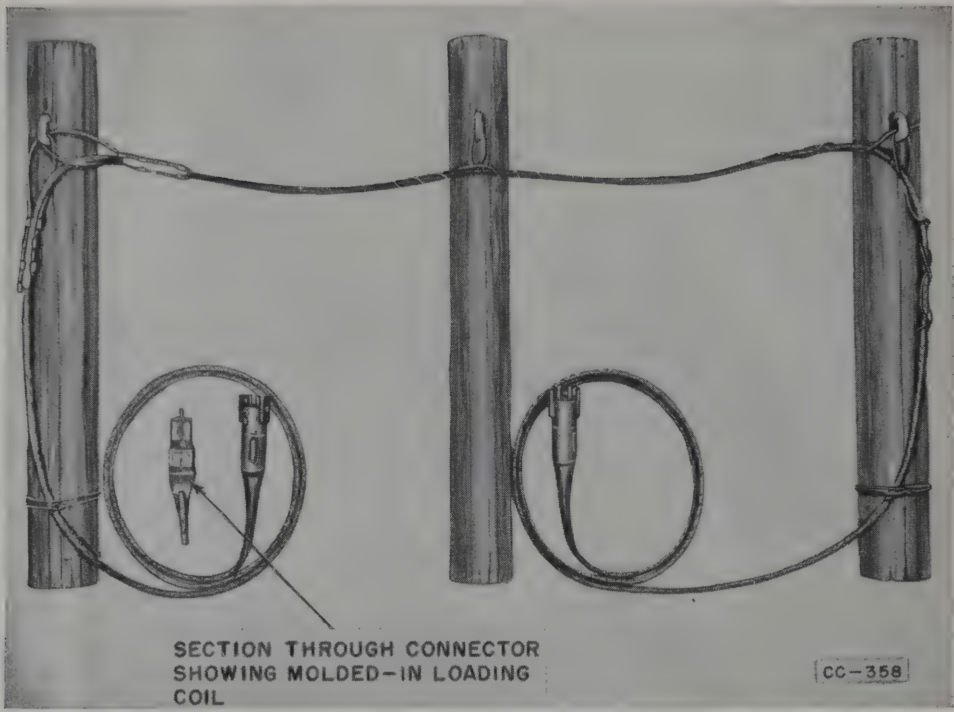


Figure 34. Cable Assembly CC–368–(*).

been provided to permit extension of the spiral-four cable. When used, Cable Assembly CC–368–(*) connects one end of the ¼-mile lengths of spiral-four cable to Cable Stub CC–356–(*), which in turn connects to the radio terminal station transmitter.

32. Running Spares, Tools, and Operating Components

A group of running spares, tools, and operating components is supplied with each receiver and transmitter combination and is stored in the drawer of Case CY–18(*)/TRC–1 housing Radio Receiver R–19(*)/TRC–1, and in either Chest BC–5 or Chest CY–64(*)/U. Spares are provided for all normally expendable items such as tubes, pilot lamps, and fuses. In addition, such operating components and tools as headsets, microphones, handsets, certain cabling, alinement tool, and tube puller are included. Case CY–67/TRC–1, providing storage for 40 transmitter and receiver crystals, is included in the drawer of Case CY–18(*)/TRC–1 or in either Chest BC–5 or Chest CY–64(*)/U.

a. The following is a detailed list of components packaged and stored in the drawer of Case CY–18(*)/TRC–1 housing Radio Receivers R–19/TRC–1 through R–19E/TRC–1:

- 1 Alinement Tool TL–150, TL–207, or TL–601/U.
- 2 cables, 10-foot, a-c (with unlettered model only).
- 1 Case CY–67/TRC–1.
- 1 Cord CD–800 (40 in).
- 1 Cord CX–8/TRC–1 or Cord CX–104/TRC–1.
- 6 fuses .15-ampere, type 3AG.
- 6 fuses .25-ampere, type 3AG.
- 6 fuses 2-ampere, type 3AG.
- 6 fuses 5-ampere, type 3AG.
- 1 Handset H–23(*)/U (Handset TS–13–(*) in the unlettered model; Handset TS–15–(*) in the A model).
- 6 pilot lamps, GE #47, or equal.
- 1 screw driver, Vaco #A–130–2K, or equal.
- 1 tube puller, Link #7489, or equal.
- 1 tube, type 5R4GY (with lettered models only).
- 2 tubes, type 6AC7.
- 1 tube, type 6H6.
- 2 tubes, type 6SH7.
- 1 tube, type 6SL7.
- 1 tube, type 6SN7.

2 tubes, type 6V6.
1 tube, type 6X5.
1 tube, type 816 (with unlettered model only).
1 tube, type 829B.

b. With equipments using Radio Receiver R–19H/TRC–1, Cases CY–67/TRC–1 are packed in Chest BC–5 or CY–64(*)/U of accessory kit No. 1 during initial shipment. The following is a detailed list of components packaged and stored in the drawer of Case CY–18(*)/TRC–1:

1 filter, air, metal, 4⅝″ x 8″ x ½″, or 4 filters, air fiberglass, same size.
10 fuses, 5-ampere, 250-volt, type 3AG.
10 fuses, 2-ampere, 250-volt, type 3AG.
10 or 20 fuses, ¼-ampere, 250-volt, type 3AG.
10 fuses, ⅜-ampere, 250-volt, type 3AG (with late H models only).
20 Lamps LM–52.
5 tubes, type 6AC7.
2 tubes, type 6H6.
2 tubes, type 6SN7 or 6SN7GT.
2 tubes, type 6SL7 or 6SL7GT.
5 tubes, type 6V6 or 6V6GT.
2 tubes, type 6X5 or 6X5GT.
2 tubes, type 829B.
2 tubes, type 5R4GY.

33. Additional Equipment Required

None of the equipments described in this technical manual normally will require any additional equipment. However, Telephone Terminals CF–1–(*), Ringing Equipments EE–101–(*), and Telegraph Terminals CF–2–(*) may require interconnecting wire. Standard types of 500-ohm characteristic impedance telephone wire pairs should be used for all of the high-fidelity circuits. Microphone extensions, if any, should be made with cable corresponding in impedance to the microphone output. Care should be taken that the additional ringing, telephone terminal, and telegraph terminal equipments do not overload the power supply, Power Unit PE–75–(*), or the power supply wiring. Tables for typewriters or call-circuit teletypewriters may be needed. An audio oscillator or other tone source may be needed for test purposes at isolated relay stations.

Section III. DIFFERENCES IN MODELS

34. General

The external appearances of the various models of the equipments are almost identical. The later models, however, have been modified to improve operational features and give better circuit performance. The major differences between the models of the equipments are given in paragraphs 35 through 41.

35. Radio Transmitter T–14(*)/TRC–1

Seven models of this transmitter, including an unlettered model and six additional models designated A through E and H, have been built. Detailed differences are explained in chapter 6.

a. Radio Transmitter T–14/TRC–1 (fig. 11) uses type 816 mercury-vapor rectifier tubes in the power supply circuit. All later models use type 5R4GY tubes for power rectification (V10 and V11).

b. Radio Transmitter T–14A/TRC–1 (fig. 4) and all successive lettered models use high-vacuum type 5R4GY tubes for power rectification. These tubes permit normal operation of the transmitter at temperatures as low as —22° F., where mercury-vapor types will not function without preheating. A simplexing circuit for Telephone EE–8–(*) has been added to the circuit and changes have been made in the microphone and CABLE COMPENSATOR circuits.

c. Radio Transmitter T–14B/TRC–1 has no design or operational changes that affect installation or operation of the transmitter. This model is the same as the A model but was procured on a different order.

d. Radio Transmitter T–14C/TRC–1 also has no design or operational changes from the A model. It was procured from a different manufacturer.

e. Radio Transmitter T–14D/TRC-1 differs

in the following way from the previous models: CARRIER CONTROL switch S4 and antenna relay RL1 have been changed to permit grounding the receiver speaker circuit on LOCAL CONTROL (position 1) when MUTE ON-OFF switch S107 (added to *Radio Receiver R–19D/TRC–1*) is ON and the handset push-to-talk switch is pressed. The second section of phase modulator tube V3 has been put to use as the first frequency doubler by the installation of transformer T11. Tube V5, which has acted as a quadrupler stage in the unlettered through C models, has been changed to the second frequency doubler stage in the D model. The over-all frequency multiplication remains 96 times the crystal frequency. A crystal dead-spot circuit (composed of L6 and C54) has been included in this model. C60 has been added to isolate the crystal from the B+ voltage.

f. Radio Transmitter T–14E/TRC–1 is the same as the D model but has been procured from another manufacturer.

g. Radio Transmitter T–14H/TRC–1 (fig. 35) incorporates all the improvements in the previous models, except that the frequency multiplying stages are the same as in the unlettered through C models.

(1) Refer to the tube function chart (table I) in paragraph 11*b* and the circuit schematic in figure 187. The second triode section of tube V1 is used as a vacuum-tube voltmeter to indicate the audio level at the output of the audio-amplifier section of tube V1; a seventh position is provided for this purpose on the METER SWITCH. Transformers T3 and T4 are dual-wound, dual-tuned, instead of the single-wound and tuned types used in the earlier models. A low-pass filter network (T11) has been in-

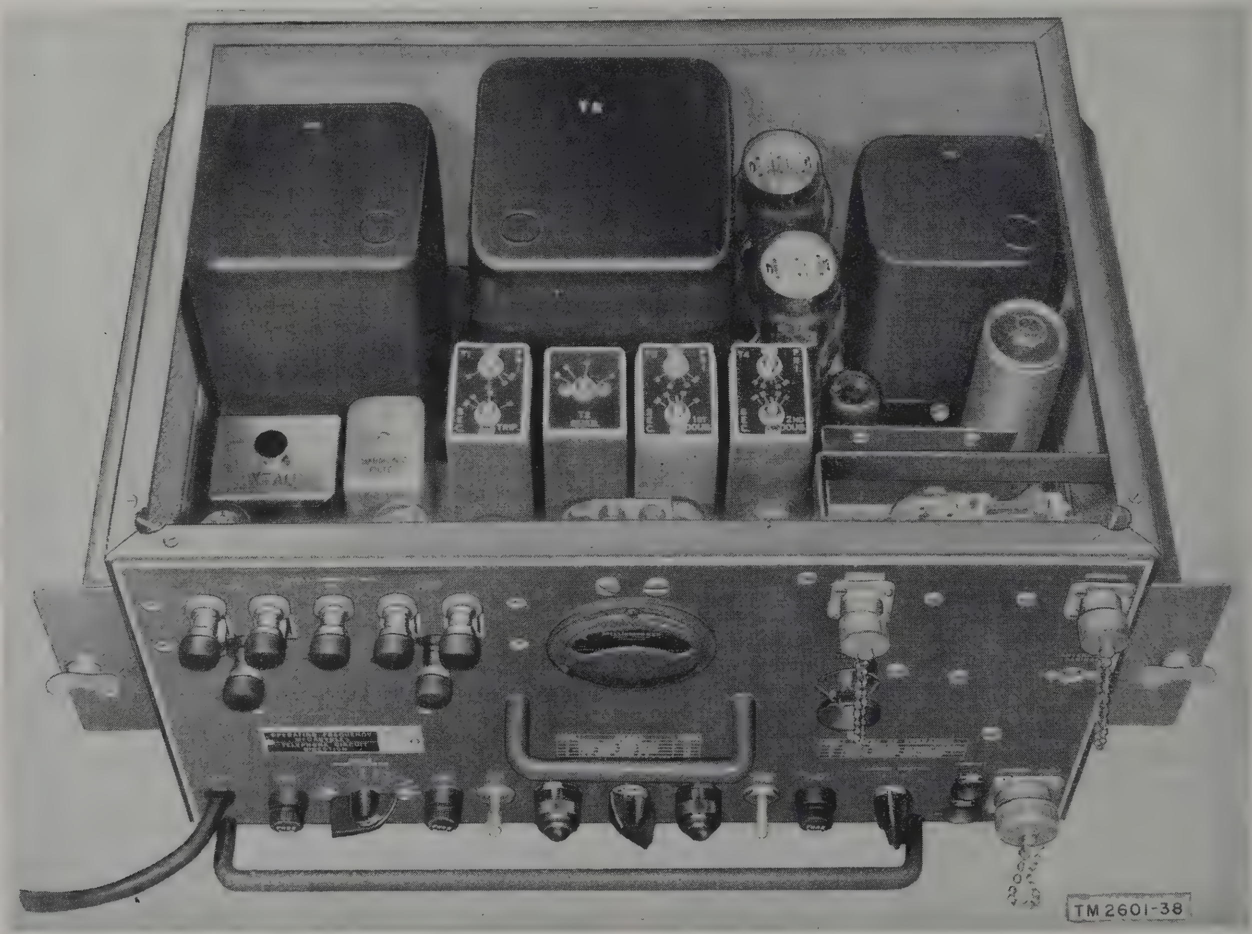


Figure 35. Radio Transmitter T–14H/TRC–1, top view of chassis.

serted in series with the r-f excitation voltage applied to phase modulator V3 from oscillator-amplifier stage V2. This filter reduces the harmonic content of the output of stage V2. The phase modulator remains the first triode section of V3.

(2) The double-tuned transformer (T11) that was used between tubes V3 and V4 in the D and E models has been removed. The microphone input circuit has been redesigned to reduce click surges caused by the microphone switch. The microphone circuit also has an added step-up a-f transformer (T12) in series with the output of low-pass filter network T9 and the audio-amplifier input circuit for raising the speech level. Power amplifier tube V9 has a protective frame to guard against shocks from accidental contact with the h-v circuits. More JAN type components are used throughout. The blower motor has an end-thrust type bearing, improving the operation in its vertical position and providing longer life.

(3) Position 3 of the CARRIER CONTROL switch has been changed to SINGLE CHANNEL CONTINUOUS. The microphone input circuit has been reconnected to allow 100 percent carrier modulation by the local handset when the CARRIER CONTROL switch is in position 3.

(4) The P. A. FUSE has been deleted and a selenium rectifier fuse (marked SEL RECT FUSE) has been added.

36. Radio Receiver R–19(*)/TRC–1

Seven receivers, including an unlettered model and six additional models designated A through E and H have been built. Detailed differences are explained in chapter 6.

a. Radio Receiver R–19/TRC–1 (fig. 12) has only 16 tubes instead of 17 as in all later models. Only one type 6X5 rectifier tube (V116) was used in this model of the receiver. MWO SIG 11–2601–2 authorizes the addition of a second 6X5 to all receivers of this model for the purpose of increasing the life of the initial single rectifier tube.

b. Radio Receiver R–19A/TRC–1 and all successive lettered models have two type 6X5 rectifier tubes. This and all successive models also have a type 6SH7 tube for the h-f i-f amplifier (V104) in place of the 6AC7 used in the unlettered model.

c. Radio Receiver R–19B/TRC–1 is the same as the A model except that spring-return LINE CHECK toggle switch S105 has been substituted for the previous push-type switch.

d. Radio Receiver R–19C/TRC–1 is the same as the B model but is procured from a different manufacturer.

e. Radio Receiver R–19D/TRC–1 and all successive lettered models have a MUTE ON-OFF switch (S107) added in the speaker circuit to permit grounding the receiver speaker when the handset push-to-talk switch is pressed. The D model and all successive lettered models have SPEAKER ON-OFF switch (S101) changed from a single-throw switch to a double-throw switch. A 6-ohm 10-watt resistor (R164) has been added across the OFF position to act as load across output transformer T113 when the speaker is turned off so that the audio level of the signal in the handset will remain constant as the speaker is switched in or out.

f. Radio Receiver R–19E/TRC–1 is the same as the D model but is procured from a different manufacturer.

g. Radio Receiver R–19H/TRC–1 (fig. 36) incorporates JAN type components and has circuits for improving the a-f response. An end-thrust type bearing in the blower motor provides longer motor life and more satisfactory operation in its vertical position.

37. Amplifier AM–8(*)/TRA–1

Six amplifiers including an unlettered model plus five later models, designated A through E have been built. Detailed differences are explained in chapter 6.

a. Amplifier AM–8/TRA–1 (fig. 37) is the original 200-watt output r-f amplifier. It uses two type 4E27 tubes for a 7-db signal gain above the radio transmitter output. Three type 0D3 tubes are used for screen voltage regulation.

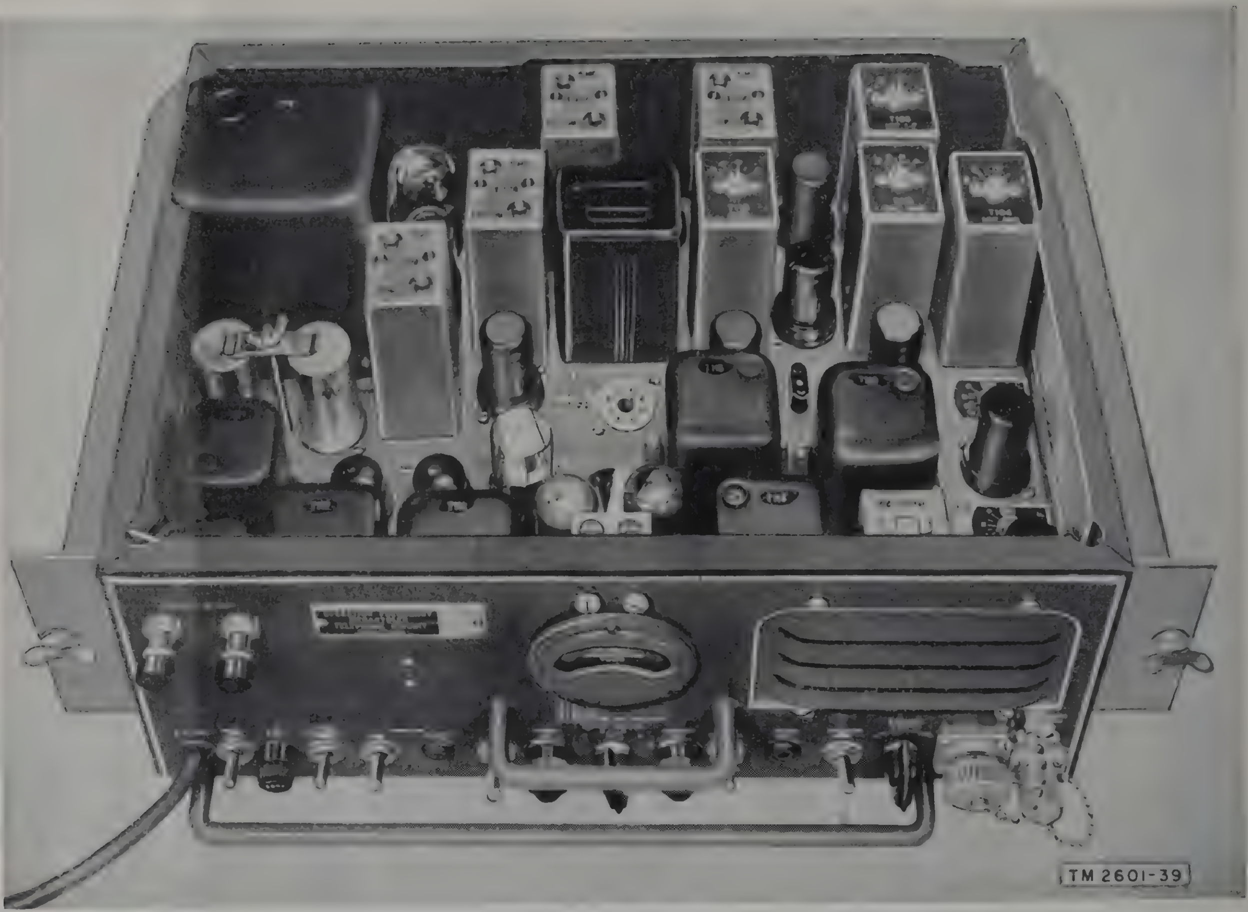


Figure 36. Radio Receiver R–19H/TRC–1, top view of chassis.

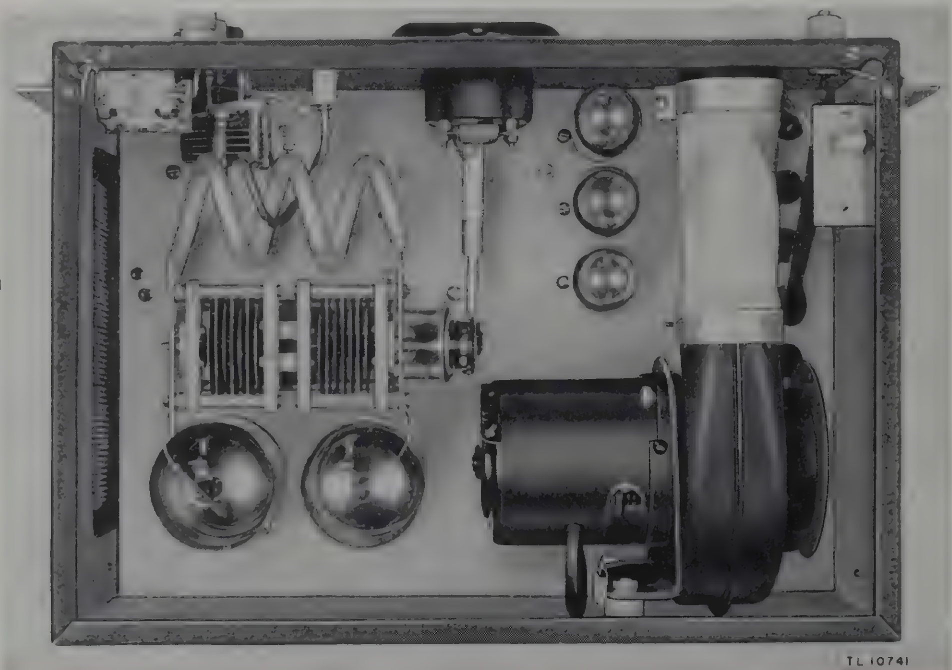


Figure 37. Amplifier AM–8/TRA–1, top view with cover removed.

b. Amplifier AM–8A/TRA–1 (fig. 4) is the same as the unlettered model.

c. Amplifier AM–8B/TRA–1 has a micro-switch substituted for the original type of door interlock switch. This switch (S205), together with its special bracket, is interchangeable with the switches furnished in Amplifiers AM–8/TRA–1 and AM–8A/TRA–1.

d. Amplifier AM–8C/TRA–1 is the same as the B model but has been procured from another manufacturer.

e. Amplifier AM–8D/TRA–1 is the same as the C model but has been made in accordance with JAN specifications and uses JAN type parts.

f. Amplifier AM–8E/TRA–1 is the same as the D model except for a different type of interlock switch.

38. Power Supply PP–13(*)/TRA–1

Six models of power supplies have been built for Amplifier AM–8(*)/TRA–1 including an unlettered model and five later models designated A through E. Detailed differences are explained in chapter 6.

a. Power Supply PP–13/TRA–1 uses mercury-vapor type 866A/866 tubes in the main power rectifier circuit. No heaters are supplied for these tubes, so operation at low air temperatures is not possible with this model.

b. There are two types of the A model. MWO SIG 11–2601–1 authorizes modification of the early A model (and unlettered model) to the electrical equivalent of the late A model.

(1) The early model of Power Supply PP–13A/TRA–1 (fig. 4) had high vacuum rectifier type 836 tubes in place of the mercury-vapor rectifiers, permitting normal operation at low (—22°F.) temperatures where the mercury-vapor tubes will not function without preheating. The two tube types are directly interchangeable and may be used in either the older or newer models without circuit modification.

(2) The late model of Power Supply PP–13A/TRA–1 has mercury-vapor rectifier type 866A/866 tubes (V302 and V303) in the h-v rectifier circuit. This late A model is equipped with tube heaters (H301 and H302) and thermostatic switches to allow proper operation of the tubes at extremely low temperatures. Heater thermostat TD304 is mounted to the rear of and near the top of tube V302. This thermostat controls the tube heaters, turning them on when the temperature is below 70° F. and turning them off when the temperature is more than 80°F. Plate thermostat TD303 is mounted to the rear and near the top of tube V303. This thermostat opens the primary of plate transformer T302 when the temperature around tube V303 is less than 55°F. The thermostat closes when the temperature rises to 65°F.

c. Power Supply PP–13B/TRA–1 (fig. 14) also is equipped with tube heaters and thermostats. In addition, the B model has a micro-switch substituted for the previous type of door interlock switch. This switch (S301), on its bracket, is interchangeable with the switches furnished on previous models.

d. Power Supply PP–13C/TRA–1 is the same as the B model but has been procured from a different manufacturer.

e. There are two types of Power Supply PP–13D/TRA–1. Figure 38 illustrates a late model.

(1) Early models of Power Supply PP–13D/TRA–1 (serial numbers 1 through 17) were the same as the C model except for a slightly larger front door which made it possible to remove the rectifier tubes without removing the top cover plate of the power supply.

(2) Late models of Power Supply PP–13D/TRA–1 (serial numbers 18 and above) use two type 3B28 tubes in place of the 866A/866 type. The 3B28 type tubes are half-wave rectifiers that are gas-filled and do not require preheating. Thus, in late D models of the power supply, tube heaters H301 and H302 and thermostats TD303 and TD304 are eliminated. Otherwise, the late models of Power Supply PP–13D/TRA–1 (fig. 38) are the same as the C

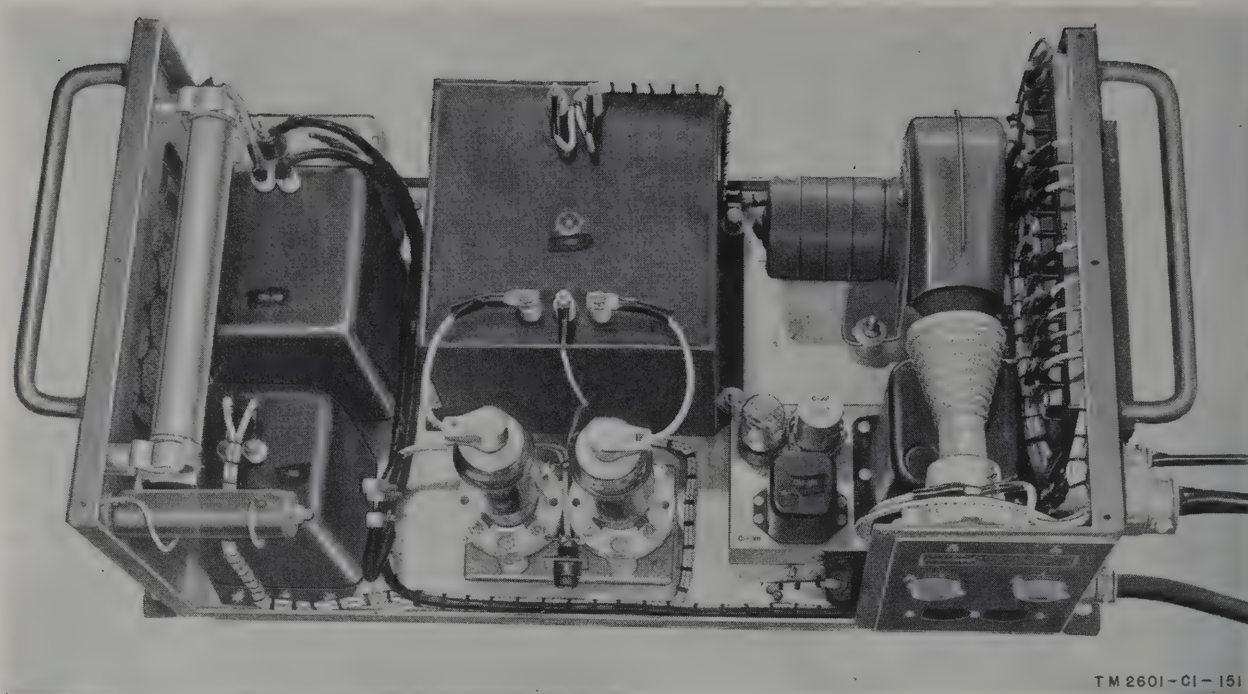


Figure 38. Late model of Power Supply PP–13D/TRA–1, top view of chassis.

model but are made in accordance with JAN specifications.

39. Test Oscillator TS–32(*)/TRC–1

Five types of test oscillators including an unlettered model and three later models designated A through D have been procured. Detailed differences are explained in chapter 6.

a. Test Oscillator TS–32/TRC–1 has the crystal socket located on top of the chassis next to the tubes under the protective cover.

b. Test Oscillator TS–32A/TRC–1 (fig. 16) and both the B and C models have the crystal sockets on the front panels to be more conveniently accessible.

c. Test Oscillator TS–32B/TRC–1 is the same as the A model. It has no changes that affect installation and operation of the equipment.

d. There are two types of Test Oscillator TS–32C/TRC–1.

(1) Early models of Test Oscillator TS–32C/TRC–1 are the same as the B model.

(2) Late models of Test Oscillator TS–32C/TRC–1 (fig. 39) have added band-flattening components added to the crystal oscillator circuit for more efficient operation throughout the whole range of frequencies covered. Late C models also have added filtering in the power input circuits.

e. The D model is the same as the late C model but has an additional B+ line bypass capacitor (C418) and different coil mounting brackets.

40. Antenna System AS–19(*)/TRC–1

Antenna System AS–19(*)/TRC–1, consisting of Antenna Support AB–33(*)/TRC–1 and Antenna AS–20(*)/TRC–1, has been procured in an unlettered model and six lettered models, A through F. Detailed component differences are listed in appendix III.

a. Antenna System AS–19/TRC–1 utilizes a 3-inch double-sheave pulley block and a 4-inch single-sheave pulley block for raising the antenna which is guyed in three directions from two different heights. The unlettered through C models use a 40-foot mast.

b. Antenna System AS–19A/TRC–1 substitutes 1½-inch sheaves for each of the larger

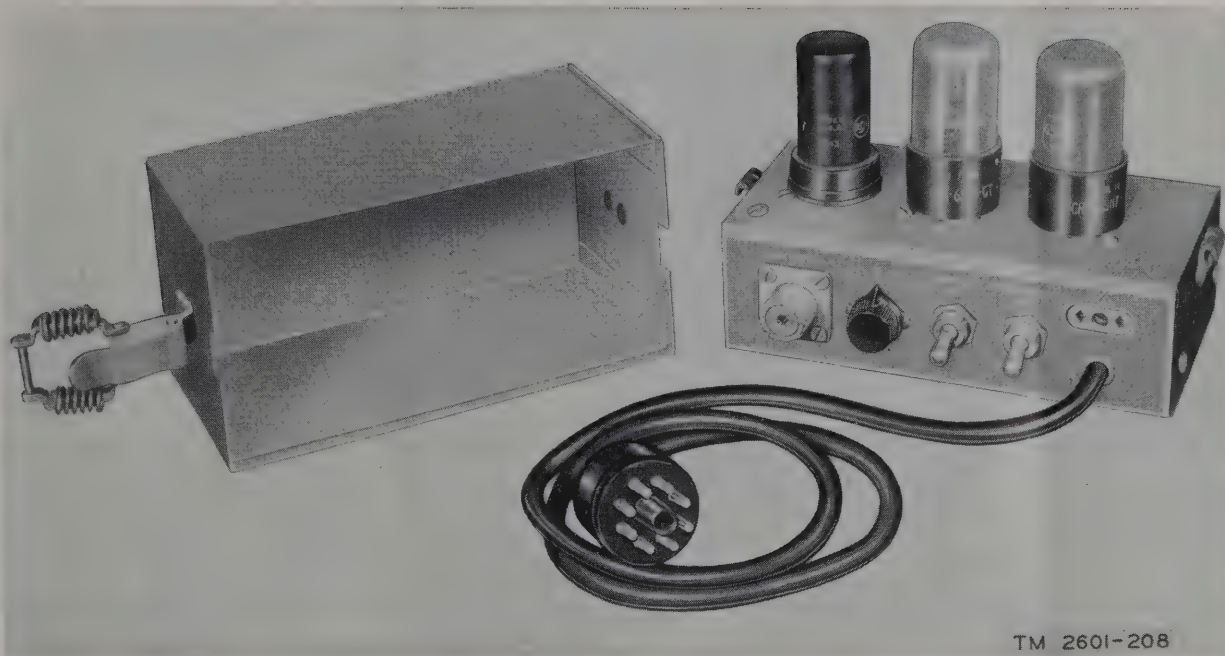


Figure 39. Late model of Test Oscillator TS–32C/TRC–1.

pulley blocks issued with the unlettered model. Four guys, instead of three, are used from the two different heights and the necessary additional guys and guy stakes are provided. The guys provided are slightly shorter than those in the unlettered model and the mast base is heavier and sturdier. A larger star drill is substituted for the star drill issued with the unlettered model. Three spare S-hooks and a scissors horse A-frame have been added to the antenna system components.

c. Antenna System AS–19B/TRC–1 (fig. 5) differs from the preceding two models in minor modifications. The two open-end wrenches have been replaced by a double-end wrench with a duplicate furnished for a spare. Three dipole couplings and six dipole rings have been added as running spares. The snaps at the upper end of the guys have been replaced by special hooks. At the lower end, the small pulley, ring, and Fitting FT–9 have been replaced by eight (five in use, three spare) stake ring-and-snap assemblies. Hammer HM–1 (2-pound) has been replaced by Hammer HM–2 (4-pound). A spare sledge handle and wedge have been added.

d. Antenna System AS–19C/TRC–1 substitutes stainless steel wire guys for the nylon guys furnished with the B model. Otherwise, the parts are interchangeable with and the system is identical in all respects to the B model. These guys should not be used with vertically polarized antennas.

e. Antenna System AS–19D/TRC–1 is the same as the B model except that the height has been increased to 50 feet by including three more mast sections and another set of guys have been added for proper guying at the increased height.

f. Antenna System AS–19E/TRC–1 (fig. 17) has the same operating components as the D model but instead of being packed in two cases it is packed in one Case CY–444/TRC–1, one Carrying Frame CY–445/TRC–1, four Cases CY–443/TRC–1, and two canvas Bags BG–102–A.

g. There are two types of Antenna System AS–19F/TRC–1. Both types have lengths of r-f coaxial cable (Cord CD–800 or CG–107/U) that differ from previous models.

(1) Early models of Antenna System AS–19F/TRC–1 are the same as the E model except that Case CY–444/TRC–1 and one Bag BG–102–(*) have been replaced by Case CY–790/TRC–1, and the Antenna AS–20F/TRC–1 beam components have been redesigned to

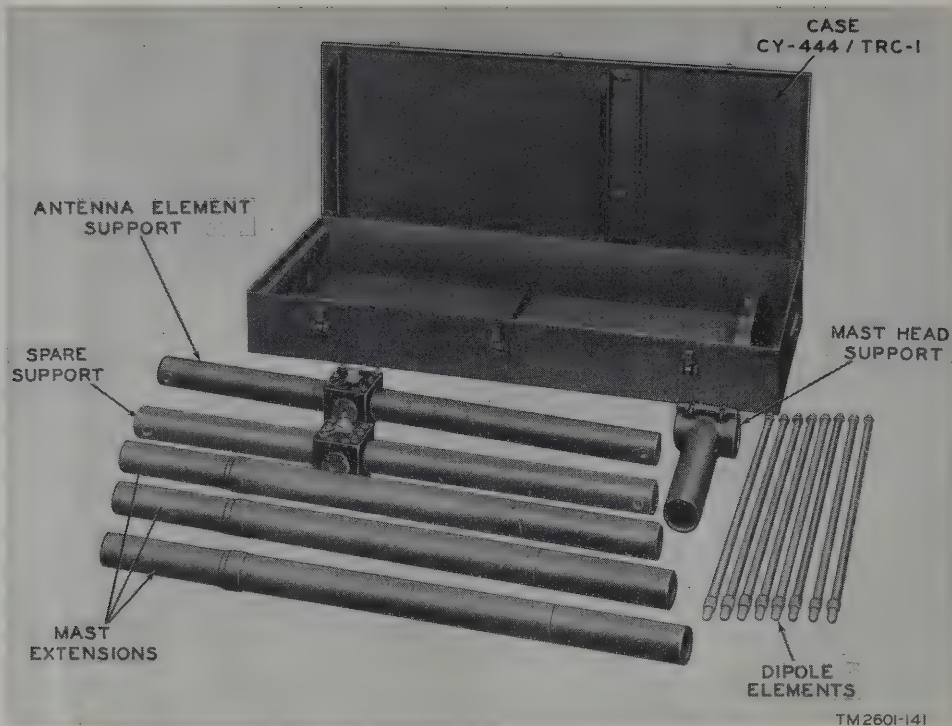


Figure 40. Components of late model Antenna AS–20F/TRC–1

cover the frequency range of 70.0 to 99.9 mc with only two adjustments.

(2) Late models of Antenna System AS–19F/TRC–1 use the same support (Antenna Support AB–33C/TRC–1 as the E and early F models. However, late models of Antenna AS–20F/TRC–1 (fig. 40) have been further modified, so that it is possible to get either vertical or horizontal polarization of the transmitted signal. This antenna may be adjusted to emit a circular pattern by using one vertical dipole.

41. Power Unit PE–75–(*)

a. General. Sixteen models of Power Unit PE–75–(*) have been procured. Variations in weights, dimensions, material, and design exist, but performance and purpose of all units are identical. Power Units PE–75–A and PE–75–B are obsolete. All other models are identified by details in which they differ from Power Unit PE–75–AD (fig. 15). Assembly of Power Unit PE–75–(*) varies with different manufacturers of the equipment. More data on these power units is contained in TM 11–900.

b. Differences in Generators. All generators used on Power Unit PE–75–(*) are identical in performance but were supplied by three different manufacturers. The three types of generators are interchangeable on all Power Units PE–75–(*). Bearings and brushes are interchangeable among the three models but all other parts must be used with the generator for which they were designed. Generators completely treated against moisture and fungi are supplied on most units of Power Unit PE–75–W and later, and on all units of Power Unit PE–75–AD and Power Unit PE–75–AE.

c. Differences in Gas Engines. All models of Power Unit PE–75–(*) are powered by Briggs and Stratton model ZZ or ZZL gas engines. Five types of model ZZ engines are used on various models. Essentially, differences on the five types of engines exist in the use of aluminum parts in type 304627; cast-iron parts in types 304633 and 304675, and pressed-steel parts on types 308104 and 308171. Type 304627 is a model ZZL engine, the suffix "L," meaning lightweight, indicating aluminum parts.

(1) Cast-iron parts were replaced by pressed-steel parts to reduce weight

and improve engine performance. A pressed-steel blower housing assembly including a cast-iron finned cylinder head was first used on the type 308104 engine. Engines with cast-iron blower cases can be converted to pressed-steel parts by interchanging 11 items as explained in TM 11–900.

(2) Cast-iron fuel-tank brackets have been replaced by pressed-steel brackets on most type 308104 engines and all of type 308171. Fuel tanks used with cast-iron brackets are supplied with welded-on cylinder head supports. This tank can be used with cast-iron or pressed-steel tank brackets. Tanks supplied on models with pressed-steel tank brackets do not have welded-on cylinder head supports and should not be used on cast-iron tank brackets.

(3) Engine type 308171, except in early models, uses Stellite-faced (chromium steel) exhaust valves and Stellite valve seat inserts and uses austenitic (hard steel) intake valves. Earlier models used austenitic valves for both intake and exhaust. Most models of type 308171 engines are equipped with a pressed-steel starter pulley and governor lever that are interchangeable with earlier cast-iron parts. The pressed-steel starter pulley can be used without the flywheel nut-lock plates used with cast-iron pulleys. Engine type 308171 is furnished with a new design crankcase equipped with a vacuum breather. This type breather is not interchangeable with the former open tube type. The crankcase is provided with a metal plate secured under the breather opening to prevent oil from entering the vacuum breather. However, the crankcase assemblies are interchangeable.

(4) Engine type 308144 is identical to type 308104 and type 308177 is identical to type 308171 except that they are supplied as replacement engines equipped with muffler assemblies, drive pulleys, and pulley key and are packaged for export shipment.

(5) Many minor differences exist in interchangeable parts used on the five types of model ZZ engines. Listed below are some items involved.

(*a*) Most type 304675 and 308104 were furnished with steel connecting rods using a removable bushing on the piston pin end. Aluminum rods were used on all other types.

(*b*) Types 308104 and 308171 are equipped with moistureproofed and fungiproofed magneto assemblies using lug type terminals on wiring connections and a new design oil ring for the magneto bearing. Earlier models used solder ends on all terminals. Types 308104 and 308171 use "T" handle fuel filters with 3/8-inch diameter (hole) shut-off valve packings. Earlier types used "L" handle filters with 5/32-inch diameter (hole) packings.

d. Differences in Power Unit Assembly. Over-all design is similar on all models of Power Units PE–75–(*). Variations exist in methods of adjusting drive belt tension, the use of wooden carrying handles, different designs of outlet and filter boxes (*e* below), methods of mounting mufflers (*f* below), and the use of spread metal and solid sheet metal belt guards.

e. Differences in Outlet and Filter Boxes. Power Units PE–75–(*) are equipped with outlet and filter boxes that differ among manufacturers of the equipment. Functions of all outlet and filter boxes are identical but they vary in design and in types of capacitors used. The greatest variation occurs in Power Unit PE–75–W and early models of Power Unit PE–75–AC. The different outlet assemblies are interchangeable on all models. Filter boxes on most Power Units PE–75–W and later models and on all Power Units PE–75–AE are treated against moisture and fungi.

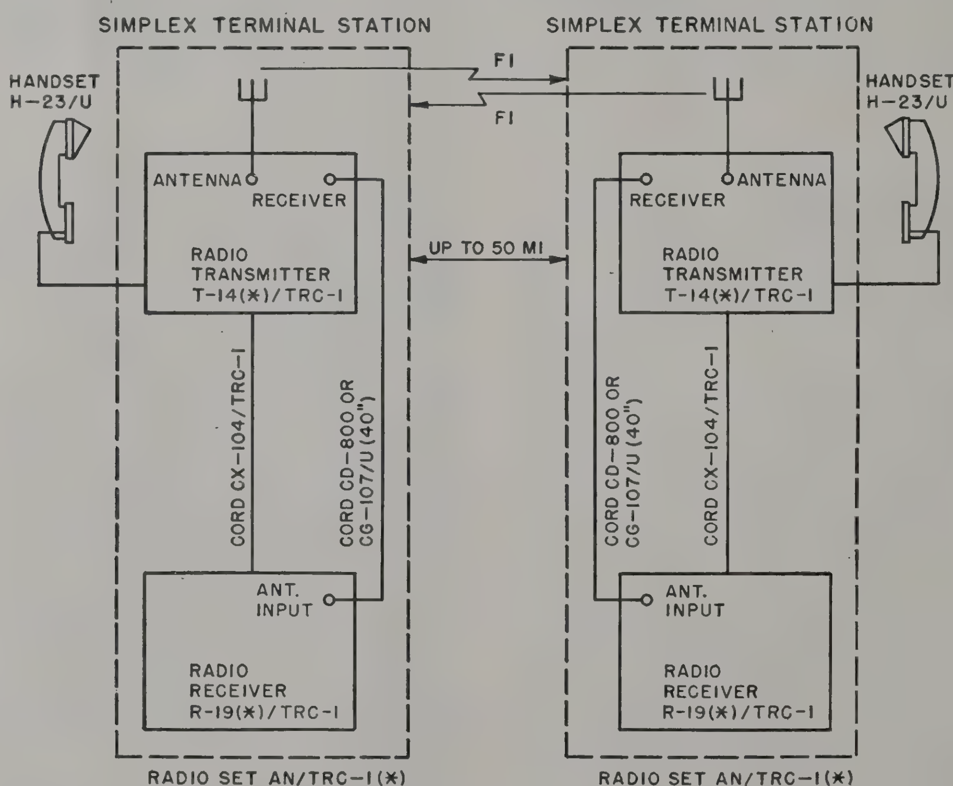
f. Differences in Muffler Mountings. Two general methods of assembling mufflers to Power Units PE–75–(*) have been used. The flexible type mounting has been discontinued on recent power units. Rigid mountings are used on current units as well as many of the earlier models. All flexible mountings can be converted to rigid type mountings.

42. General

a. The applications of Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), and Radio Relay Set AN/TRC–4(*) are so varied, because of their flexibility, that all the specific uses will not be covered. The following described applications cover those of most general interest. As the personnel of using organizations become better acquainted with the equipment, other applications may be found.

b. Since each of these sets is made up of the same basic components and differs only in the quantity of basic components and in the amount of maintenance equipment and certain minor components, the sets can, with discretion, be used for the same purposes. In general, Radio Set AN/TRC–1(*) is used where intermittent service is required, while Radio Terminal Set AN/TRC–3(*) and Radio Relay Set AN/TRC–4(*) are used where continuous service is required. All three sets can be used in single-channel or multichannel systems.

c. Intermittent service is service where the interval between use is sufficient to insure keeping the equipment in repair or where the service is only for short intervals of time. Thus, the danger of equipment failure during a period of operation is minimized. Intermittent service may be 3 or 4 hours continuous use each day or 2 to 3 days continuous each week. Continuous service means 24 hours per day without



NOTES:

1. TWO STATIONS SET UP FOR SINGLE–CHANNEL, PUSH–TO–TALK, ONE–DIRECTION–A–TIME COMMUNICATION SYSTEM.
2. USES ONE FREQUENCY FOR BOTH DIRECTIONS. TWO FREQUENCIES MAY BE USED. ANTENNA ADJUSTED TO TRANSMITTER FREQUENCY.
3. CONTROL OF TRANSMITTER CARRIER AND ANTENNA CHANGE–OVER FROM RECEIVER TO TRANSMITTER MADE BY PUSH–TO–TALK SWITCH ON HANDSET.

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Figure 41. Use of Radio Sets AN/TRC–1(*) as ordinary simplex single-channel field radio set.

interruption. Even 12 hours per day may be considered continuous service, if, during these 12 hours there can be no prolonged interruptions due to failure of some component. When failure does occur during continuous service, it is intended that service be interrupted only for the few minutes required to replace the entire basic component which failed by one of the immediately available spare basic components.

43. Radio Set AN/TRC–1(*) Used as Ordinary Radio Set

Radio Set AN/TRC–1 (*) may be used as an ordinary transportable field radio set for either simplex or duplex voice communication between two points up to normal distance of 25 miles. Distances up to 50 miles may be practicable assuming a reasonable line-of-sight path.

a. SIMPLEX COMMUNICATION. Figure 41 shows a block diagram of two Radio Sets AN/TRC–1 (*) used for ordinary single-channel simplex voice communication between two points. *Simplex* operation means two-way communication between two points, but only in one direction at a time. While the operator at one station is transmitting, his receiver is inoperative. When he is receiving a transmission from another station, he cannot make that station hear him until it stops sending. That is, the receiving operator cannot talk to the sending operator until the sending operator has completed his transmission and has released his push-to-

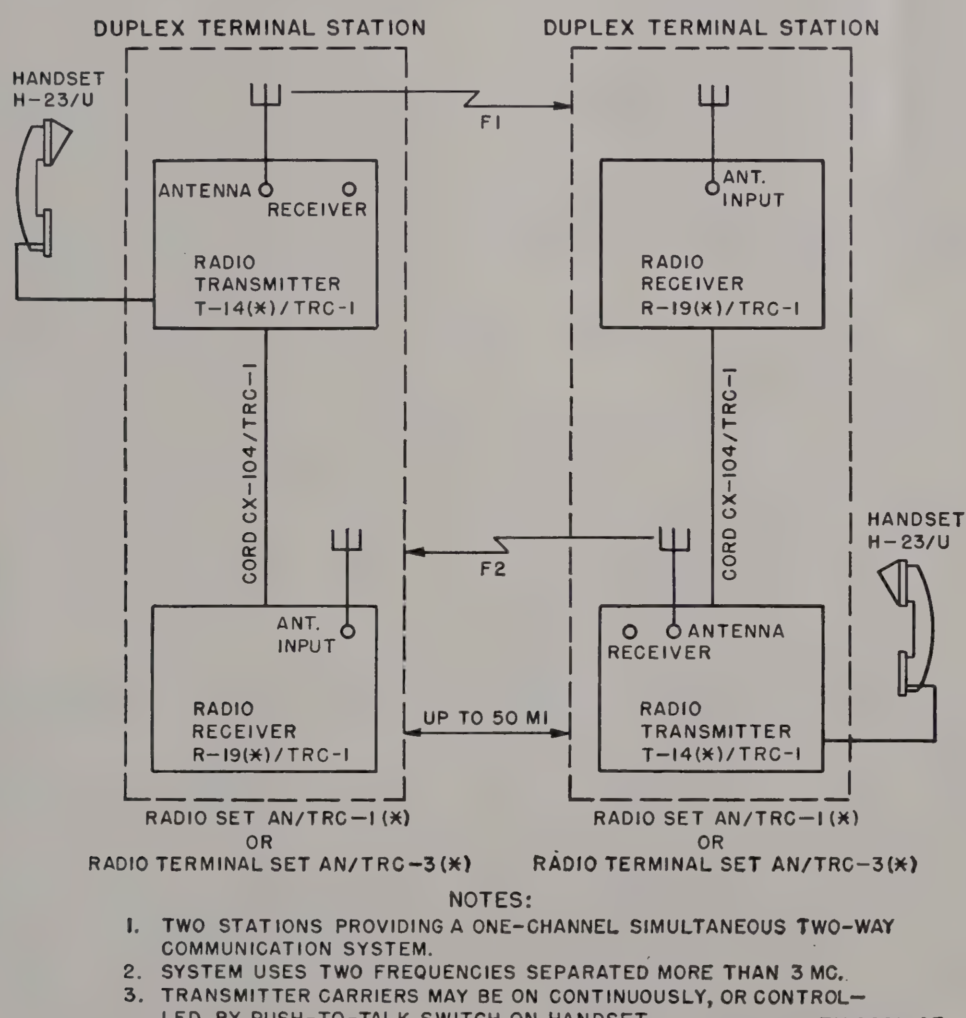


Figure 42. Use of Radio Sets AN/TRC–1(*) as an ordinary duplex single-channel field radio set.

talk switch on the handset. Simplex communication has the advantage that only one operating frequency is required; each transmitter carrier is on only while talking after pressing the push-to-talk switch of the handset. Single-channel simplex operation requires only one of the three antenna systems supplied with each Radio Set AN/TRC–1(*).

b. DUPLEX COMMUNICATION. Figure 42 shows a block diagram using two Radio Sets AN/TRC–1(*) as ordinary field radio sets for single-channel duplex communication between two points. This arrangement uses two operating frequencies. It normally provides one voice channel in each direction. The communication can take place in both directions simultaneously enabling the operators to talk to each other as in normal conversation. By providing auxiliary telegraph terminal equipment or facsimile equipment at each station, it is possible to send facsimile or one to four telegraph channels both ways simultaneously in place of the voice channel. During voice communication between both stations, both transmitter carriers may be left on continuously or each transmitter carrier may be turned on when the push-to-talk switch of the handset is pressed.

44. Radio Sets AN/TRC–1(*) in Single-channel Radio-relay System

The communication distance between two Radio Sets AN/TRC–1(*) used as ordinary field sets may be greatly increased by interposing other Radio Sets AN/TRC–1(*) at intervals of 35 miles, or less, for the purpose of relaying the communication in both directions. The number of relay stations that can be used depends on the type of traffic that is to be handled. The total distance that can be covered depends on terrain conditions, the type and quantity of traffic to be handled, and the reliability expected. This system handles much less traffic than the duplex communication systems using Radio Relay Sets AN/TRC–4(*) and Radio Terminal Sets AN/TRC–3(*).

a. SIMPLEX PUSH-TO-TALK AT TERMINAL STATION SYSTEM.

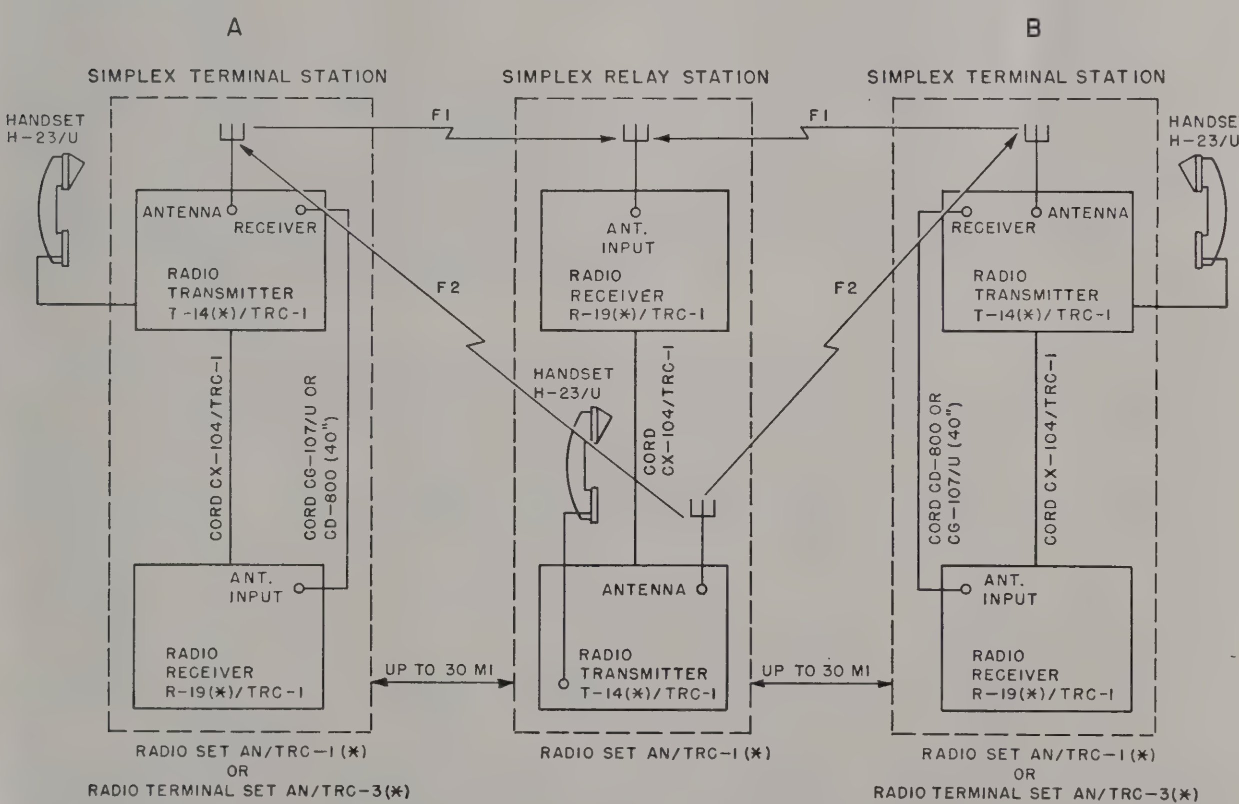
(1) The simplex relay communication system, which permits only one channel of communication in one direction at a time, is limited to *one* radio-relay station of the type shown in figure 43. In this system, the transmitter carrier at the relay station can be left on continuously or it may be controlled from the squelch relay of the receiver so that the carrier is turned on only when the receiver picks up the incoming signal.

(2) If intermittent service is expected, the entire system may be made up of Radio Sets AN/TRC–1(*). If continuous service is expected, the system must be made up of Radio Terminal Sets AN/TRC–3(*). This is a case where one Radio Terminal Set AN/TRC-3(*) can function as a relay station (simplex relay station only).

(3) Since the relay station must be receiving and transmitting at the same time, it is necessary that the transmitter and receiver have separate antennas and that the sending frequency be different from the receiving frequency. Also, since the terminal stations use but one antenna for both the transmitter and receiver, it is necessary that the two frequencies (F1 and F2 in fig. 43) be close enough so that the antennas can send or receive without being detuned too much. When the unlettered through early F models of Antenna AS–20(*)/TRC–1 are used, F1 and F2 should be within 5mc of each other. The late F models have two separate bands; both frequencies should fall in the same band (par. 65*b*). The antenna at each terminal station, if it is an unlettered through early F model antenna, must be tuned to a frequency midway between operating frequencies F1 and F2. The antennas at the relay station must be operated without the director and reflector elements because the transmitter has to transmit in both directions and the receiver has to receive from both directions. The transmitter antenna (at the relay station) must be tuned to operating frequency F2 and the receiver antenna to F1.

(4) This system is limited in its traffic capabilities and distance coverage. It has the advantages that only two frequencies are required and that the carriers may be on only during actual periods of communication. It has the disadvantage that communication can take place in only one direction at a time. It is practically limited to voice communication; it would not be practical to send telegraph or facsimile as this would require manual switching from send to receive at the terminal stations.

(5) When the operator at one terminal wishes to talk to the operator at the other terminal, he presses the push-to-talk switch of the handset and starts talking. Pressing this switch energizes the change-over relay so that the antenna which normally is connected to the receiver is switched to the transmitter. Plate power is applied automatically to the transmitter tubes, and the transmitter is modulated as the operator talks into the microphone. This signal (at frequency F1) is picked up by the radio receiver at the simplex relay station. If the relay station is operating continuous carrier, the audio output of the receiver will modulate the transmitter at the relay station which will retransmit the signal on operating frequency F2. If the relay station is operating SINGLE CHANNEL CARRIER OPERATE,



NOTES:

1. TWO STATIONS CONNECTED BY A SIMPLEX RELAY PROVIDING SINGLE-CHANNEL, PUSH-TO-TALK, ONE-DIRECTION-AT-A-TIME COMMUNICATION SYSTEM.
2. THE SYSTEM USES TWO FREQUENCIES.
3. EACH END STATION USES ONE ANTENNA.
4. TRANSMITTER CARRIER AT RELAY SET CONTROLLED BY SQUELCH-CONTROLLED RELAYED IN ASSOCIATE RECEIVER.
5. CONTROL OF TRANSMITTER CARRIER AND ANTENNA CHANGE-OVER FROM RECEIVER TO TRANSMITTER, MADE BY PUSH-TO-TALK SWITCH ON HANDSET.

TM 2601-25

Figure 43. Simplex single-channel radio communication system.

the incoming signal to the receiver will operate the squelch relay, which in turn will turn the transmitter on (just as though it were turned on by the push-to-talk switch of the handset). The audio output from the receiver modulates the transmitter and the signal is retransmitted on frequency F2. The receiver at the opposite terminal picks up the signal on frequency F2; the antenna at this terminal is connected to the receiver during the reception period.

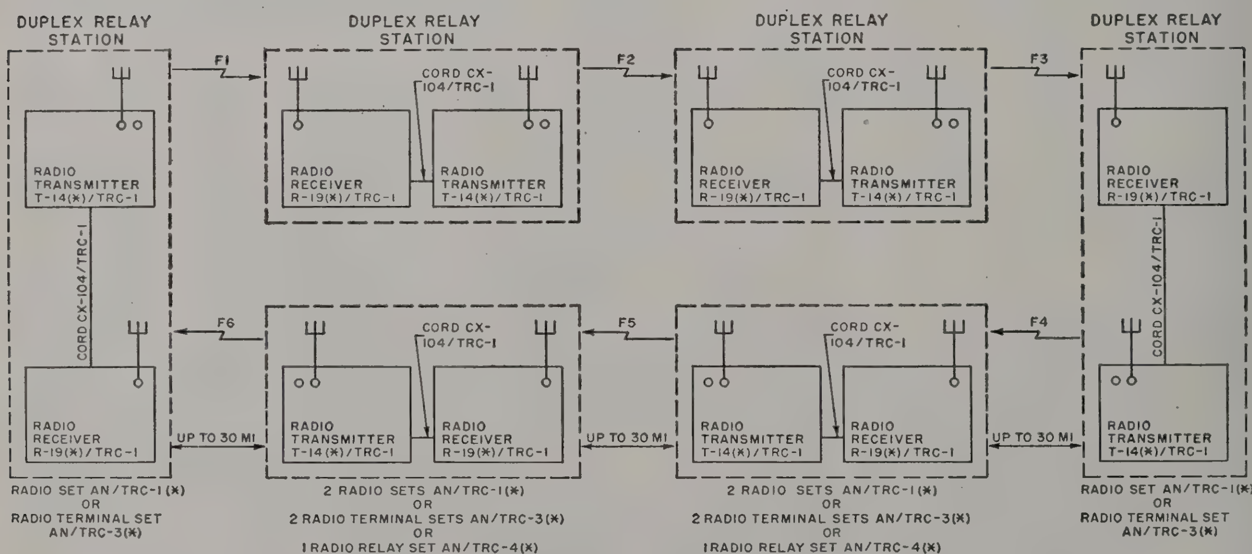
b. Duplex Push-To-Talk at Terminal Station System.

(1) Figure 44 shows the block diagram of a single-channel duplex radio-relay system. *Duplex* operation, which means communication in both directions at the same time, is accomplished by using separate antenna systems for each transmitter and receiver. The transmitter and receiver at each location must be separated in frequency by *at least 3mc* if they are to be used at the same time. In this type of system, up to 6 or 7 radio-relay stations may be spaced at intervals of 25 to 35 miles to extend the communication to greater distances. One channel of voice communication is possible both ways simultaneously. By operating the transmitter carriers continuously, it is practical to use this one channel for teletypewriter or facsimile.

(2) In this system, all transmitter carriers sending communications in one direction may be on only while the communications are being sent, or all carriers may be left on continuously, depending on the desired mode of operation.

(3) When it is desired that the carriers be on only while communications are being sent, both terminal stations operate push-to-talk with the CARRIER CONTROL switch at LOCAL CONTROL (position 1), and the radio relay stations are carrier operated with the carrier control switch at SINGLE CHANNEL CARRIER OPERATE (position 2).

(4) When it is desired that all carriers be on continuously, the continuous mode of operation is used with the CARRIER



NOTES:
1. TWO STATIONS CONNECTED BY DUPLEX RELAY PROVIDING A ONE-CHANNEL SIMULTANEOUS TWO-WAY COMMUNICATION SYSTEM.
2. FREQUENCY SEPARATION BETWEEN ANY TRANSMITTER AND RECEIVER AT ANY ONE STATION MUST BE MORE THAN 3 MC.
3. ALL TRANSMITTER CARRIERS MAY BE ON CONTINUOUSLY, OR TERMINAL CARRIERS MAY BE CONTROLLED BY BUTTERFLY SWITCH ON HANDSET H-23/U WHILE RELAY CARRIERS ARE CONTROLLED BY SQUELCH-OPERATED RELAY IN ASSOCIATED RECEIVERS.

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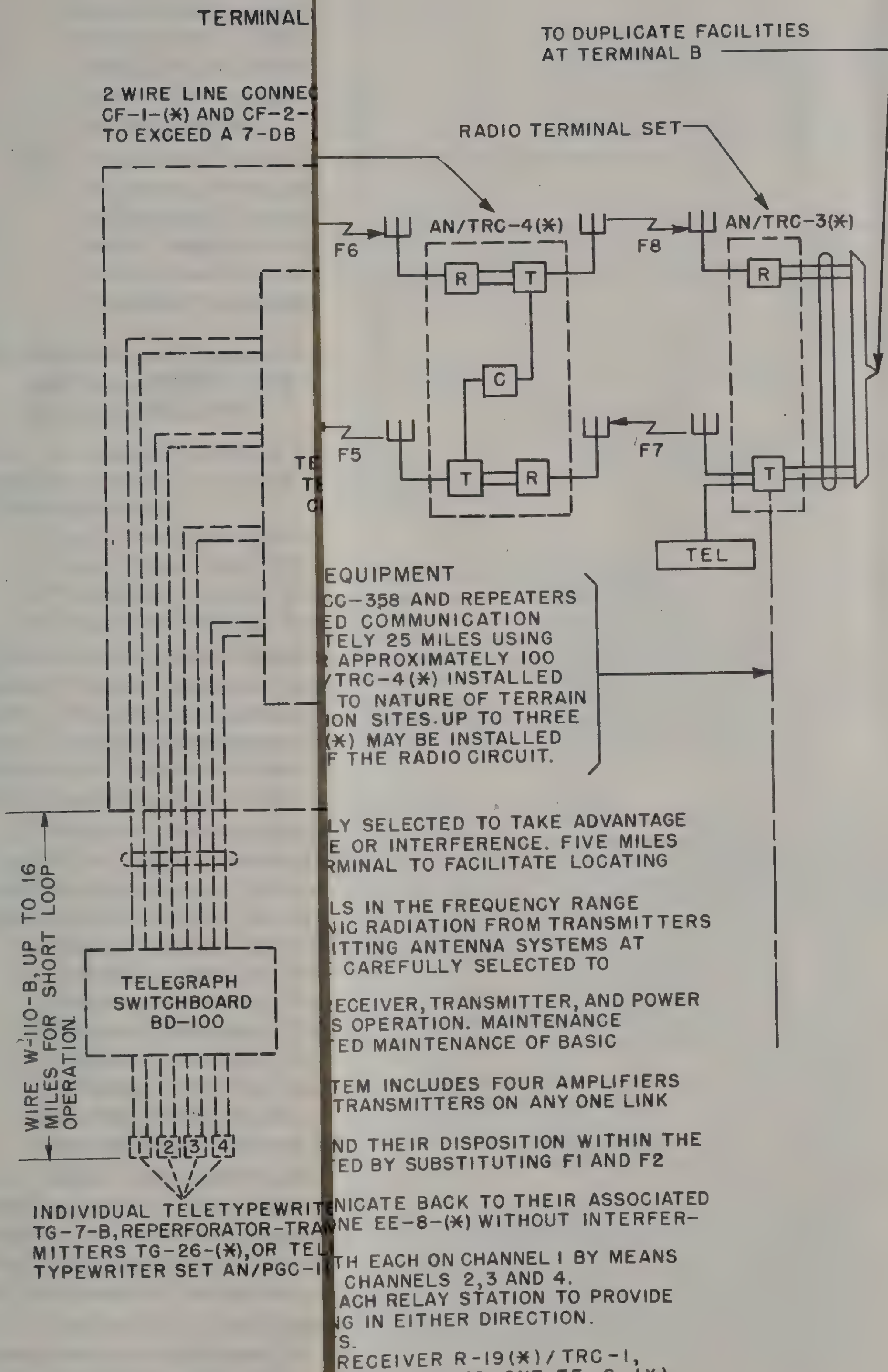
Figure 44. Duplex single-channel radio communication system.



TERMINAL
TO DUPLICATE FACILITIES
AT TERMINAL B
2 WIRE LINE CONNE
CF-1-(*) AND CF-2-
TO EXCEED A 7-DB
RADIO TERMINAL SET
AN/TRC-4(*)
AN/TRC-3(*)
F6
F8
F5
F7
R
T
C
TE
T
C
TEL
EQUIPMENT
CC-358 AND REPEATERS
ED COMMUNICATION
TELY 25 MILES USING
APPROXIMATELY 100
/TRC-4(*) INSTALLED
TO NATURE OF TERRAIN
ION SITES. UP TO THREE
(*) MAY BE INSTALLED
F THE RADIO CIRCUIT.
LY SELECTED TO TAKE ADVANTAGE
E OR INTERFERENCE. FIVE MILES
RMINAL TO FACILITATE LOCATING
LS IN THE FREQUENCY RANGE
NIC RADIATION FROM TRANSMITTERS
ITTING ANTENNA SYSTEMS AT
CAREFULLY SELECTED TO
RECEIVER, TRANSMITTER, AND POWER
S OPERATION. MAINTENANCE
TED MAINTENANCE OF BASIC
TEM INCLUDES FOUR AMPLIFIERS
TRANSMITTERS ON ANY ONE LINK
ND THEIR DISPOSITION WITHIN THE
TED BY SUBSTITUTING F1 AND F2
NICATE BACK TO THEIR ASSOCIATED
NE EE-8-(*) WITHOUT INTERFER-
TH EACH ON CHANNEL 1 BY MEANS
CHANNELS 2,3 AND 4.
ACH RELAY STATION TO PROVIDE
NG IN EITHER DIRECTION.
S.
RECEIVER R-19(*)/TRC-1,
TEL IS TELEPHONE EE-8-(*).
WIRE W-110-B, UP TO 16
MILES FOR SHORT LOOP
OPERATION.
TELEGRAPH
SWITCHBOARD
BD-100
1
2
3
4
INDIVIDUAL TELETYPEWRIT
TG-7-B, REPERFORATOR-TRA
MITTERS TG-26-(*), OR TEL
TYPEWRITER SET AN/PGC-1

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the incoming signal to the receiver will operate the squelch relay, which in turn will turn the transmitter on (just as though it were turned on by the push-to-talk switch of the handset). The audio output from the receiver modulates the transmitter and the signal is retransmitted on frequency F2. The receiver at the opposite terminal picks up the signal on frequency F2; the antenna at this terminal is connected to the receiver during the reception period.

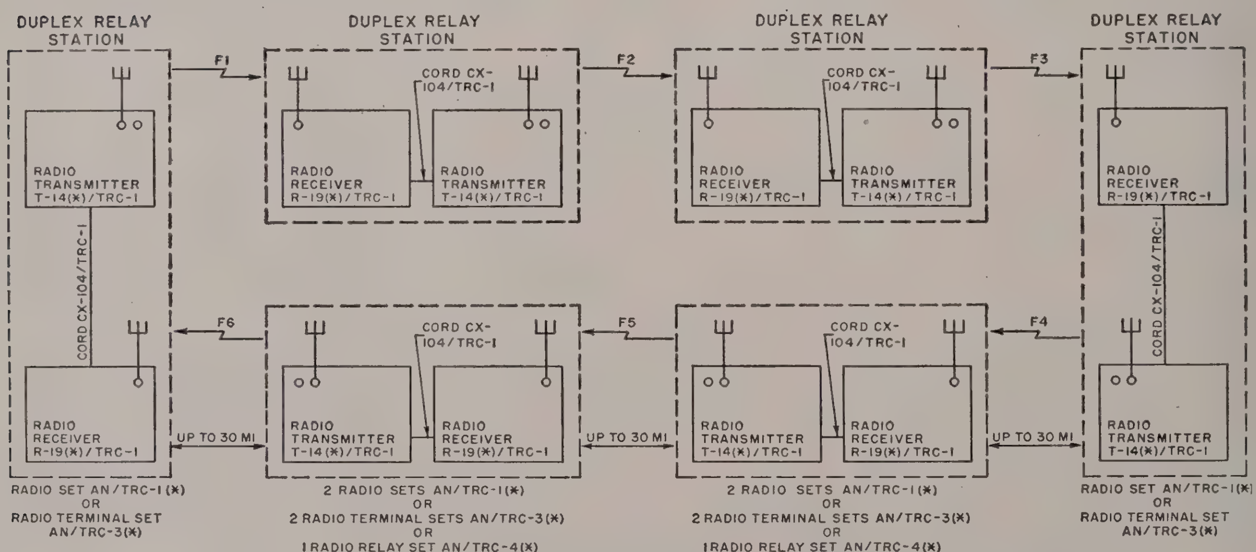
b. DUPLEX PUSH-TO-TALK AT TERMINAL STATION SYSTEM.

(1) Figure 44 shows the block diagram of a single-channel duplex radio-relay system. *Duplex* operation, which means communication in both directions at the same time, is accomplished by using separate antenna systems for each transmitter and receiver. The transmitter and receiver at each location must be separated in frequency by *at least 3mc* if they are to be used at the same time. In this type of system, up to 6 or 7 radio-relay stations may be spaced at intervals of 25 to 35 miles to extend the communication to greater distances. One channel of voice communication is possible both ways simultaneously. By operating the transmitter carriers continuously, it is practical to use this one channel for teletypewriter or facsimile.

(2) In this system, all transmitter carriers sending communications in one direction may be on only while the communications are being sent, or all carriers may be left on continuously, depending on the desired mode of operation.

(3) When it is desired that the carriers be on only while communications are being sent, both terminal stations operate push-to-talk with the CARRIER CONTROL switch at LOCAL CONTROL (position 1), and the radio relay stations are carrier operated with the carrier control switch at SINGLE CHANNEL CARRIER OPERATE (position 2).

(4) When it is desired that all carriers be on continuously, the continuous mode of operation is used with the CARRIER



NOTES:
1. TWO STATIONS CONNECTED BY DUPLEX RELAY PROVIDING A ONE-CHANNEL SIMULTANEOUS TWO-WAY COMMUNICATION SYSTEM.
2. FREQUENCY SEPARATION BETWEEN ANY TRANSMITTER AND RECEIVER AT ANY ONE STATION MUST BE MORE THAN 3 MC.
3. ALL TRANSMITTER CARRIERS MAY BE ON CONTINUOUSLY, OR TERMINAL CARRIERS MAY BE CONTROLLED BY BUTTERFLY SWITCH ON HANDSET H-23/U WHILE RELAY CARRIERS ARE CONTROLLED BY SQUELCH-OPERATED RELAY IN ASSOCIATED RECEIVERS.

TM 2601-28

Figure 44. Duplex single-channel radio communication system.

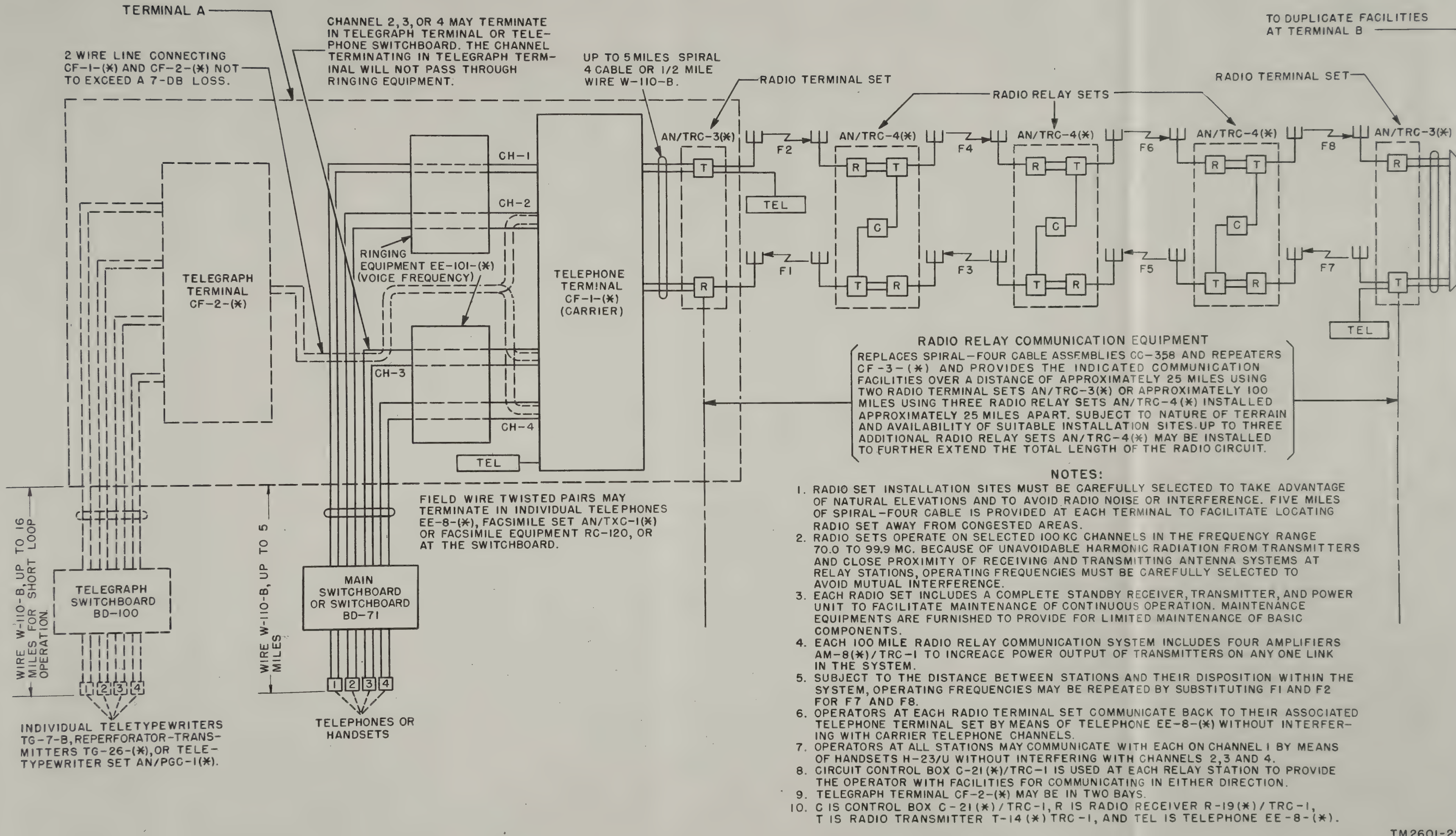


Figure 45. Multichannel v-h-f radio system.

CONTROL switch at both terminals and all relay stations set at MULTI-CHANNEL CONTINUOUS. The SINGLE CHANNEL CONTINUOUS position (3) is used with H models of the transmitter.

(5) This system normally is used for single-channel voice but can be used for one channel of facsimile or four channels of telegraph in place of the single voice channel by using the proper type of auxiliary equipment (par. 45).

45. Multichannel System Using Radio Terminal Sets AN/TRC-3(*) and Radio Relay Sets AN/TRC-4(*)

a. A complete standard multichannel communication system (fig. 45) consists basically of the following:

2 Radio Terminal Sets AN/TRC-3(*)
3 Radio Relay Sets AN/TRC-4(*)
2 Telephone Terminal Sets TC-21-(*)
2 Telegraph Terminal Sets TC-22-(*)

It provides four voice communication channels between points separated approximately 100 miles. The telegraph terminal set and its associated telegraph equipment at each terminal enables four telegraph communication channels to be placed on any one of the voice channels.

b. Figure 45 shows a simplified block diagram of the major components of a complete communication system. Terminal A of this consists essentially of the following:

1 Radio Terminal Set AN/TRC-3(*)
1 Telephone Terminal CF-1-(*) (part of Telephone Terminal Set TC-21-(*))
2 Ringing Equipments EE-101-(*)
1 Telegraph Terminal CF-2-(*) (part of Telegraph Terminal Set TC-22-(*))
Associated telephone and telegraph facilities and up to 5 miles of spiral-four cable.

c. Radio Terminal Set AN/TRC-3(*) normally is located at any distance up to 5 miles from the v-f carrier equipment on some mountain or suitable site and is connected to the carrier equipment by the spiral-four cable.

d. Terminal B at the distant location comprises identical equipment in an arrangement similar to that at terminal A.

e. Three Radio Relay Sets AN/TRC-4(*) are located at approximately 25-mile intervals or are spaced at elevated sites approximately within line-of-sight distances; this may range from 20 to 40 or more miles, depending on the nature of the terrain.

f. The number of relay stations which can be used will depend entirely on the amount and nature of the traffic to be handled, the r-f noise at any receiving site, and the signal loss over the existing terrain over which the system must be operated. It likewise will depend on the capabilities of the operating team.

g. Normally, the system provides four voice channels, capable of being operated in both directions simultaneously, between terminals A and B. Channel 1 (also called the *microphone* or *order* channel) normally is reserved as the system service channel. All radio operators in the system are in communication with each other, the same as on a complete party telephone line, by using channel 1. An extra communication channel may be had by using Telegraph Terminal TH-1/TCC-1 and a teletypewriter on the order channel (No. 1). At the terminal stations, the radio operator enters into channel 1 by merely talking into and listening with his local handset. At the radio-relay stations, the radio operator enters channel 1 merely by throwing the switch of Control Box C-21(*)/TRC-1 (figs. 18 and 85) in the direction he wishes to communicate, then talking into and listening with his local handset. The wire operator or the party at the extreme telephone terminal end of channel 1 enters into channel 1 in the same manner as he would enter into any of the other three voice channels. The other three channels cannot be entered into at the relay stations nor can the relay operators know the nature of the traffic being handled on the upper three voice channels. These upper three channels (Nos. 2, 3, and 4) may terminate, along with channel 1, at a switchboard (fig. 45).

h. If any of the four channels on the two-wire line side of Carrier Terminal CF-1-(*) is used for voice, then that channel must be passed through Ringing Equipment EE-101-(*) so that ringing facilities are available. Ringing Equipment EE-100-(*), if available, may be substituted for Ringing Equipment EE-101-(*).

i. Telephone Terminal AN/TCC-3 may be

used with these equipments. Channel 5 will be transmitted over two and possibly three jumps.

j. Any of the channels (Nos. 1, 2, 3, and 4) used for facsimile or telegraph must be bypassed around the ringers or connected directly to their respective terminals on the v-f carrier equipment.

k. Those channels which are used for telegraph channels are terminated in Telegraph Terminals CF–2–(*). Each telephone channel can accommodate four channels of two-way telegraph, controlled by teletypewriter printing equipment, such as Teletypewriters TG–7–B or TT–55/MGC. The facsimile or teletypewriter equipment used must be supplied as auxiliary equipment to the standard system. Some of the possible traffic facilities for such a system are—

- 4 voice channels
- 3 voice and 4 telegraph channels
- 3 voice and 1 facsimile channels
- 2 voice, 1 facsimile, and 4 telegraph channels
- 2 voice and 8 telegraph channels
- 1 voice and 12 telegraph channels
- 1 voice, 1 facsimile, and 8 telegraph channels
- 1 voice, 4 telegraph, and 2 facsimile channels
- 1 voice and 3 facsimile channels

46. Radio Set AN/TRC–1(*) in Multichannel Radio Communication System

a. Radio Set AN/TRC–1(*) can be used in a complete multichannel radio-relay system by using one Radio Set AN/TRC–1(*) at each terminal instead of Radio Terminal Set AN/TRC–3(*) and by using two Radio Sets AN/TRC–1(*) to make up each radio-relay station instead of Radio Relay Set AN/TRC–4(*) (fig. 45). Radio Sets AN/TRC–1(*) are used in a complete multichannel communication system only when intermittent service is expected, since there will be no stand-by transmitters, receivers, or power units available in case of break-down.

b. Control Box C–21(*)/TRC–1 will not be available at each relay station, thereby requiring the use of two handsets at each station for the system service channel. The two handsets have to be crossed over while the operator uses them, since each handset transmits toward one terminal and receives from the opposite terminal. In all other respects, the information and instructions given in paragraph 45, for the radio communication system using Radio Terminal Sets AN/TRC–3(*) and Radio Relay Sets AN/TRC–4(*), are the same for Radio Sets AN/TRC–1(*).

47. Operation of Several Stations in Close Proximity

It is possible to use several Radio Sets AN/TRC–1(*) at one location, each serving as a terminal station for a communication system. The essential precautions for such a set-up are that the operating frequencies of the various transmitters and receivers be selected so that the interference into the receivers from the spurious radiations of the transmitters will be minimized. The charts in paragraphs 134 should be studied closely.

48. Multichannel Radio System Using Radio Terminal Sets AN/TRC–3(*)

a. Radio Terminal Set AN/TRC–3(*) can be used in a complete multichannel radio-relay system (fig. 45) by using one Radio Terminal Set AN/TRC–3(*) at each radio terminal station and by using two Radio Terminal Sets AN/TRC–3(*) at each radio-relay station.

b. The use of two terminal sets at the relay stations and one terminal set at each terminal station assures continuous operation. Since there is no Control Box C–21(*)/TRC–1 on the parts list for Radio Terminal Set AN/TRC–3(*), it is necessary that two handsets be used at each relay station in the same manner as for Radio Sets AN/TRC–1(*) in relay applications (par. 46*b*).

c. The information given in paragraph 45 for the multichannel communication system using Radio Terminal Set AN/TRC–3(*) and Radio Relay Set AN/TRC–4(*) applies to a system made up of Radio Terminal Sets AN/TRC–3(*).

d. It is sometimes advantageous, for the sake of flexibility, to use Radio Terminal Sets AN/TRC–3(*), exclusively, to make up the terminals and relay stations of a system. By making vehicular installations of one Radio Terminal Set AN/TRC–3(*) in each vehicle,

two of these installations can run to the desired position and operate as one radio-relay station.

49. Miscellaneous Applications

Other applications for use of this equipment will arise as the using personnel become familiar with the technical aspects of the respective units. For example, this equipment often is used to control banks of h-f transmitters. It is not the intent of this manual to outline all the applications of wide-band radio relay and radio terminal equipment. However, keep in mind that this equipment will replace a length of spiral-four cable and that anything that can be transmitted over a wire line can be transmitted by this equipment.

50. Amplifier Equipment AN/TRA–1(*)

a. Amplifier Equipment AN/TRA–1(*) consisting of one Power Amplifier AM–8(*)/TRA–1 and one Power Supply PP–13(*)/TRA–1 is used with (but is not part of) the radio sets whenever it is necessary to increase the power output from Radio Transmitter T–14(*)/TRC–1.

b. The amplifier equipment has an r-f power output of 200 watts when excited from the output of Radio Transmitter T–14(*)/TRC–1. This provides a 7-db power gain which is useful when operating over an otherwise marginal circuit. For ordinary situations where the received signal strength at the distant receiver is 10 uv or more over the noise level, the amplifier equipment may not be necessary.

c. Because of its weight and the space it occupies, Amplifier Equipment AN/TRA–1 is mostly reserved for use where the station is relatively permanent.

d. By properly distributing the load on the power units, it is possible to use two power amplifier equipments at a relay position.

Table III. Radio Relay Traffic Facilities

Mode of operation	Associated terminal equipment		Traffic channels available				Distance with maximum number relays		Factors limiting total communication (See notes corresponding to numbers listed)
	Telephone Terminal Set TC–21–(*)	Telegraph Terminal Set TC–22–(*)	Order channel	Telephone	Telegraph[a]	Facsimile[a]	Maximum number relay stations	Approximate miles total	
Single-channel simplex.	----------	----------	----------	1	----------	----------	[b]1	[b]60	1, 2
	----------	----------	----------	----------	----------	1	[b]1	[b]60	1, 2
	----------	CF–2–(*)	----------	----------	4	----------	[b]1	[b]60	1, 2
Single-channel duplex.	----------	----------	----------	1	----------	----------	7	300	1, 2, 3, 6
	----------	----------	----------	----------	----------	1	7	300	1, 2, 3
	----------	CF–2–(*)	----------	----------	4	----------	7	300	1, 2, 3
Multichannel radio communication system.	CF–1–(*)	----------	1	3	----------	----------	5	225	1, 2, 3, 4, 5, 6, 7
	CF–1–(*)	CF–2–(*)	1	2	4	----------	5	225	1, 2, 3, 4, 5, 6, 7
	CF–1–(*)	CF–2–(*)	1	1	8	----------	4	190	1, 2, 3, 4, 5, 6, 7
	CF–1–(*)	CF–2–(*)	1	----------	12	----------	4	190	1, 2, 3, 4, 7
	CF–1–(*)	CF–2–(*)	1	1	4	1	4	190	1, 2, 3, 4, 5, 6
	CF–1–(*)	CF–2–(*)	1	----------	4	2	5	225	1, 2, 3, 4
	CF–1–(*)	CF–2–(*)	1	----------	----------	3	5	225	1, 2, 3, 4
	----------	CF–2–(*)	----------	----------	4	----------	7	300	1, 2, 3
	CF–1–(*)	----------	1	2	----------	----------	6	260	1, 2, 3, 4, 5, 6
	CF–1–(*)	CF–2–(*)	1	----------	8	----------	6	260	1, 2, 3, 4

[a]Facsimile and teletypewriter equipments have to be supplied as auxiliary equipments.
[b]When using simplex type of relay station.

Notes

1. Availability of reasonable line-of-sight paths.
2. Local noise at each terminal and relay station.
3. Total accumulated noise.
4. Interchannel modulation originating from channel 1 telephone carrier. (Using Telegraph Terminal TH–1/TCC–1 increases this.)
5. Interchannel modulation channels, 2, 3, and 4.
6. Accumulated distortion.
7. Drop of frequency response at high audio frequency.

51. Tabulation of Traffic Facilities and Limitations

Table III shows the number of traffic channels which are made available with the different modes of operation described above. It likewise shows the limitations which should be expected for each application. Greater distances or more relay stations will require better than average maintenance and alinement. Carefully tended and highly peaked systems of 10 relay stations have been successfully operated.

CHAPTER 2
INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

52. Siting
(fig. 46)

a. EXTERNAL REQUIREMENTS. The best location for radio equipment depends on the tactical situation and local conditions, such as the following: the need to house the equipment where its shelter cannot be seen, the type of housing available, possible installation in a vehicle, the terrain, and the need of easy access to messengers. Signals from Radio Transmitter T–14(*)/TRC–1 have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception and transmission, because the surrounding high terrain absorbs r-f energy. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, power lines, or power units. Choose, if possible, a location on a hilltop or elevation. Normally, transmission over water is better than over land. See that drainage is adequate to prevent flooding the interior of any equipment cases. If the equipment is part of a communication center but is not installed within the center, locate the equipment nearby. In locating the antenna, avoid obstructions which are above the horizontal plane of the antenna in the direction of desired transmission.

Figure 46. Selecting an antenna location.

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b. INTERIOR REQUIREMENTS. The shelter for the equipment must meet the following requirements:

(1) The floor must be capable of sustaining the weight of the equipment in a level position without vibration, or the equipment may be set on dry ground.

(2) Sufficient space must be available for possible repair work and for door swing as explained in (4) below.

(3) There must be sufficient ceiling height for the radio equipment and any associated telephone, ringing, carrier, or telegraph equipment.

(4) Sufficient space may be allowed behind the equipment to run power cords and excess cabling, and so that auxiliary equipment doors may be opened. Sufficient space must also be provided in front of the equipment so that it is possible to operate and adjust the transmitter and receiver. Except for these limitations, the equipment may be located anywhere near the antenna location and power connections. If it is set up in the open, the case fronts should be protected during bad weather.

(5) Adequate lighting for day and night operation should be provided. Position the equipments so that the panel designations may be read easily by the operating personnel. Artificial lighting may be accomplished with light bulbs so placed that the light falls directly on the panel. A portable drop lamp and extension cord (included in some accessory kits) are useful for operating and maintenance personnel.

c. GENERAL. Installation and operation of these radio sets may vary considerably with the type of service required. The principles and considerations outlined in paragraphs 52 through 60 are important for any type of system and must be followed for satisfactory operation. For purposes of clarity, concealment features are not shown in figure 46. However, all necessary precautions must be taken. Refer to FM 5–20 and TM 5–267 for camouflage instructions.

53. Line-of-sight Transmission

a. GENERAL. Communication with these radio sets is accomplished in the v-h-f band of 70 to 100 mc. Radio waves at these frequencies tend to travel in straight lines. For this reason, line-of-sight transmission paths are of major importance as signal strength attenuates rapidly over paths which have obstructions between the transmitter and receiver. Although the radio waves bend slightly around obstructions, ordinarily, reliable communication occurs only when line-of-sight paths exist. Line-of-sight transmission is attained when the transmitter antenna is theoretically within optical range of the receiver antenna. The most important factors limiting the line-of-sight distance are the curvature of the earth and intervening hills.

b. CURVATURE OF EARTH. The curvature of the earth limits the distance over which line of sight occurs. For example, with both the transmitting and the receiving antennas located 40 feet above sea level, the maximum distance that can be spanned before the line of sight is intercepted by the curvature of the earth is approximately 18 miles. This assumes the altitude of the intervening terrain also to be at sea level. In order to obtain a line-of-sight path 50 miles long, the height of each antenna must be at least 312.5 feet above sea level and the altitude of the intervening terrain must be at sea level. To determine the maximum distance between two radio stations *with the intervening terrain at sea level,* the following formula is used:

$$D = \sqrt{2HT} + \sqrt{2HR}$$

where:

D = distance in miles

HT = height in feet of transmitting antenna

HR = height in feet of receiving antenna.

c. OVER IRREGULAR TERRAIN.

(1) Propagation characteristics over irregular terrain are in marked contrast with those for smooth earth or sea water. Here, the variation of field intensity with distance depends largely on the profile of the terrain between the transmitting and receiving antennas. An increase in distance may result in either decreased or increased field intensity, depending on the par-

ticular topography involved. Substantial changes in field intensity may result from relocating stations, even without any change in the distance between them.

the 70- to 100-mc band will require a received field intensity of 10 db or more above 1 uv per meter. Note that each three-element beam has a gain of 6 db over the half-wave dipole on

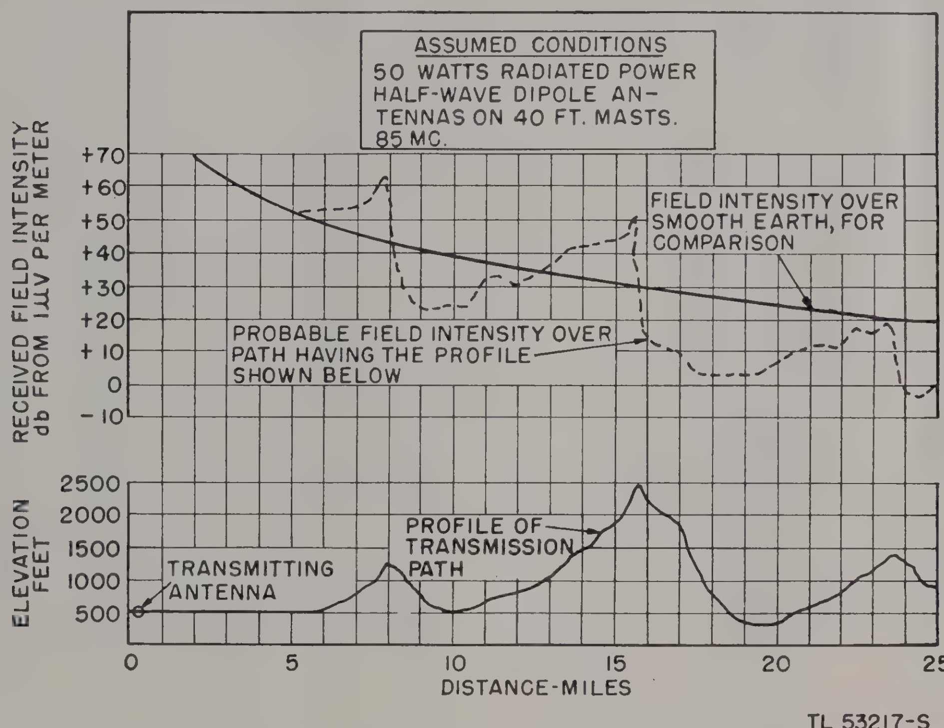


Figure 47. V-h-f propagation over hilly terrain.

(2) Propagation over irregular terrain is illustrated by figure 47, which shows in profile an assumed transmission path over hills together with values of field intensity likely to be received at various points along the path. This figure emphasizes two facts regarding transmission in hilly country; first, that *the choice of antenna sites is very important* and second, that *there is no satisfactory basis for calculating general distance ranges*. Instead, the received field intensity may be estimated for a given site involving a path of known profile, and thus the selection of antenna sites may be based on the circuit performance estimated for various available locations.

(3) Normally, single channel operation in which figure 47 is based. A considerable amount of data on v-h-f propagation is given in paragraphs 607 through 638 of TM 11–486.

d. INTERVENING HILLS. Intervening hills in a transmission path reduce signal strength when they obstruct the line of sight. Radio waves bend over these obstructions slightly, but bending is accompanied by a loss in signal strength; the greater the bending, the greater the loss. Certain combinations of communication sites and intervening hills may provide satisfactory signals due to reflections, but this condition is realized only by luck or by calculation with detailed terrain maps. It can be predicted reliably that satisfactory communication will be obtained if line of sight prevails. If line of sight does not exist, the path must be tested first to determine whether the site is suitable.

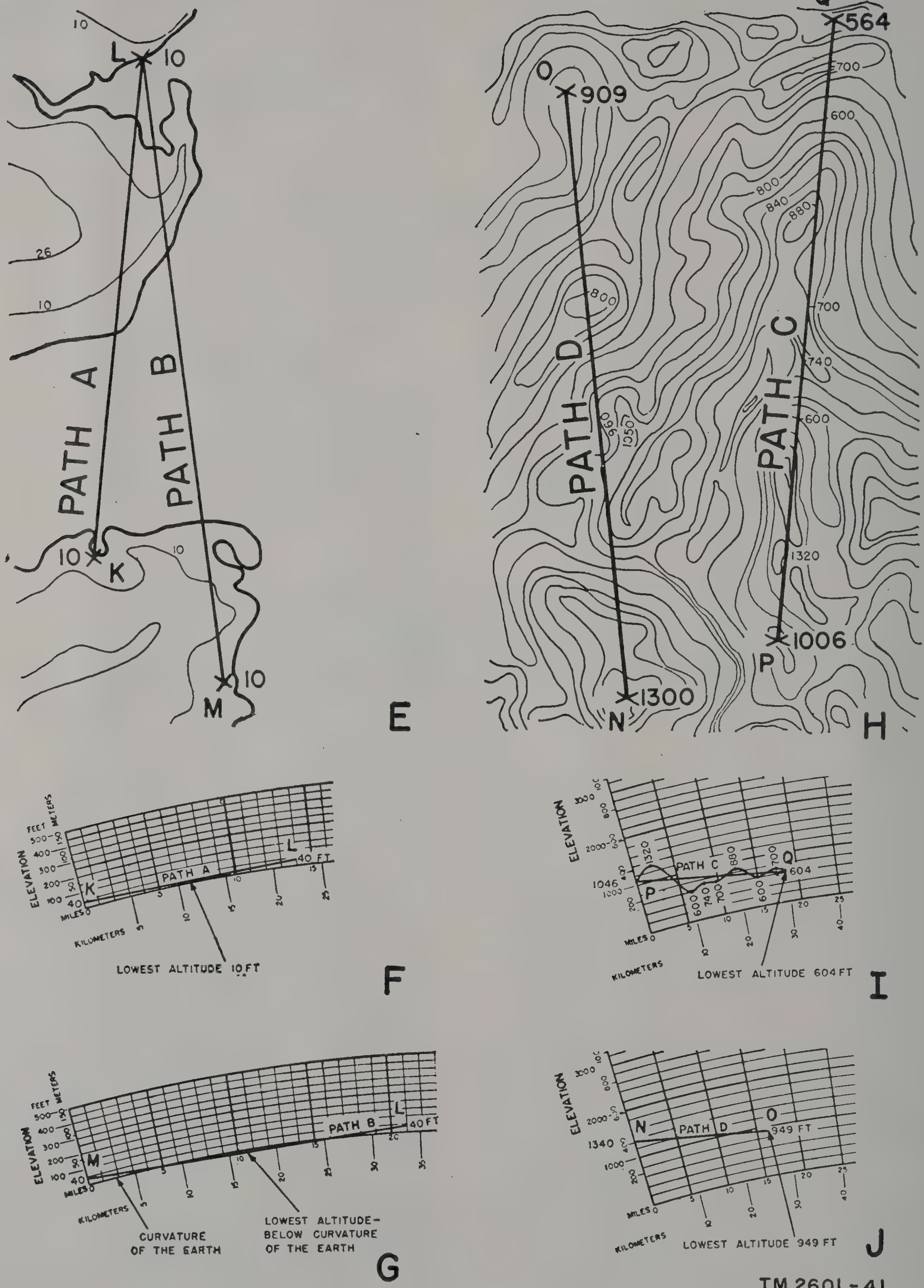


Figure 48. Plotting profiles.

GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS

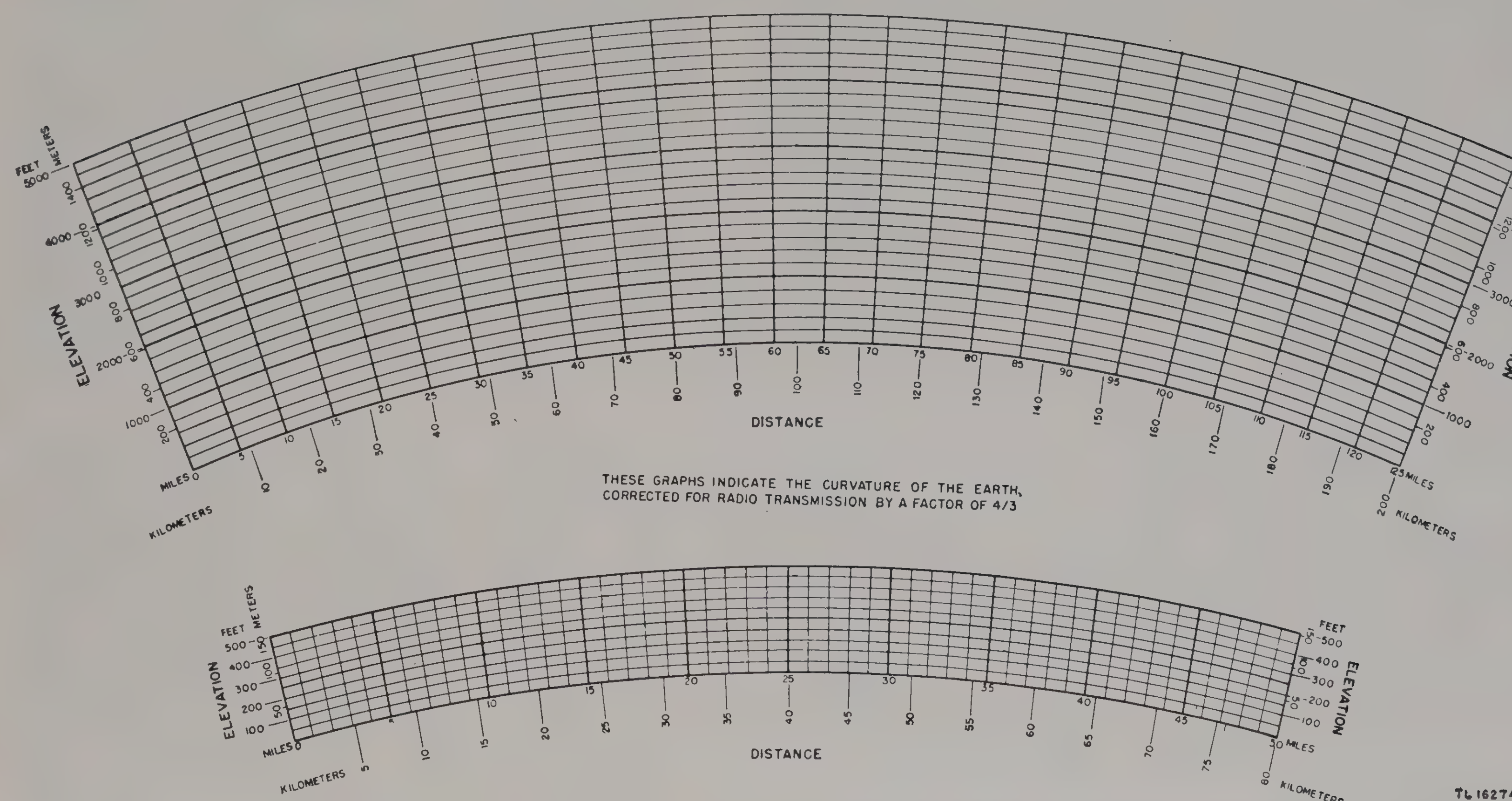


Figure 49. Nonlinear graph paper.

54. Plotting Profiles on Nonlinear Graph Paper

To determine whether a line-of-sight path exists before attempting an installation, a profile should be drawn (fig. 48). Graph paper similar to that of figure 49 is furnished at the rear of this manual for plotting profiles from terrain maps. Either of the two graphs may be used, depending on the elevations and distances between the two proposed sites. The upper graph is used for elevations up to 5,000 feet and distances up to 125 miles. The lower graph will accommodate elevations up to 500 feet and distances up to 50 miles. This graph paper is used as follows:

a. Determine from the terrain map the scales used for distances and elevations.

b. Draw a line on the terrain map between the two proposed sites (A and B in E of fig. 48, C and D in H of fig. 48). Measure the length of this line and convert it to the distance between the two points.

c. Determine the elevation at each site as indicated by the contour lines. Add the height of the antenna mast to this figure to arrive at the total elevation. For example, referring to path D (H, fig. 48), station N is 1,300 feet high. Adding the antenna height, in this case 40 feet, brings the total elevation to 1,340 feet. This point is marked off on the vertical scale of the graph above 0 miles (J, fig. 48). Station O of path D has an indicated elevation of 909 feet. This height plus the antenna height of 40 feet gives a total elevation of 949 feet. This is plotted on the vertical scale (J, fig. 48) above the 16-mile point, since 16 miles is the distance between the two sites.

d. Draw a straight line between these two points, scan this line, and determine the point of lowest altitude. On path D this is 949 feet; on path A (F, fig. 48) the lowest altitude is 10 feet and on path B (G, fig. 48), it is below the curvature of the earth.

e. Scan the terrain map and note if there are any points above the point of lowest altitude. If there are none, as on path D, line of sight exists and no further plotting is necessary.

f. If there are elevations above the point of lowest altitude, as on path C, draw a complete profile (I, fig. 48). Follow the line drawn on the terrain map and pick out high and low points. Plot these points on the graph paper and join them. All points which project above the straight line on the graph represent intervening terrain.

g. If there are intervening hills between the two proposed sites, as in path C, or if the site line is below the curvature of the earth, as in path B (G, fig. 48), unreliable communication may result. Do not use such paths. However, if there are no intervening hills, as in paths A and D, good communication will be obtained.

h. If the proposed site is intended for a relay station, the transmission path to each relay or terminal station must be considered. A *line of sight must exist in both directions.*

i. Test the site finally chosen by installing and operating the equipment.

55. Plotting Profiles on Linear Graph Paper

If profile graph paper is not available, a profile may be plotted on any linear graph paper and then corrected for the curvature of the earth by using table IV.

a. Determine from the terrain map the scales used for distances and elevations. Draw a line on the terrain map between the two proposed sites.

b. Pick out high and low points along the line and plot these on the graph paper (fig. 50). The uncorrected profile path is plotted as a broken line curve on this type of graph paper, as the example shown in figure 50.

c. Draw a line on the graph paper between the two terminal points, A and B.

d. Correction must be made for the curvature of the earth to obtain a true picture of the line-of-sight path. A high or low point is selected which is as near as possible to the point halfway between the terminals (in this case R). Next, by means of the figures shown in table IV, the heights of all prominent points in both directions from this central point must be corrected (shown as a solid line curve). For example, point P shown in figure 50 is 6 miles from reference point R. After correction, P becomes P^1, which is 28 feet lower than the original point.

e. Some profile maps will indicate a line-of-sight path with the drawing uncorrected. With the correction, however, many intervening objects may become apparent.

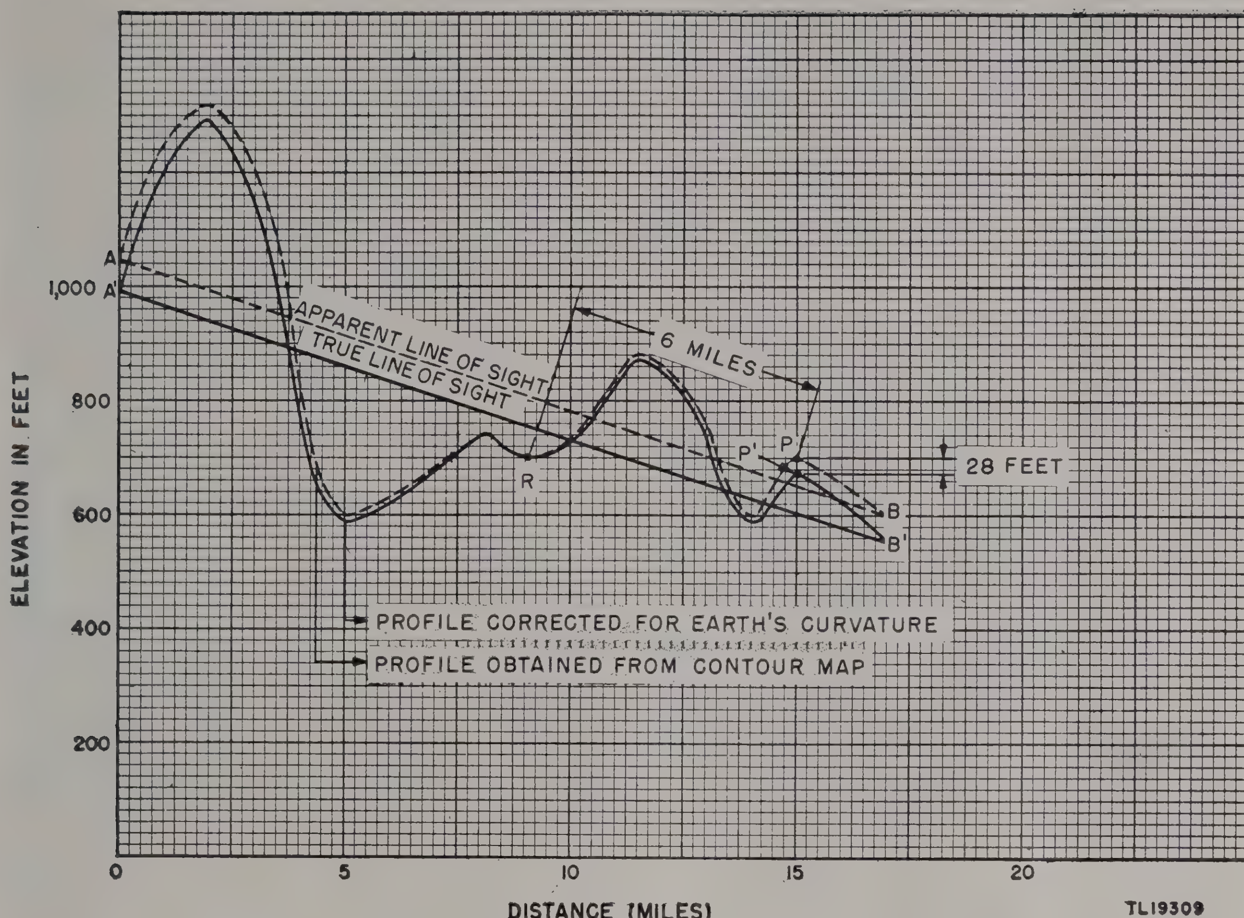


Figure 50. Plotting profiles on linear graph paper.

f. In table IV, the corrected elevation in feet equals $\frac{D^2}{1.5}$ k, where k is the ratio of the effective radius of the earth to the true radius of the earth, and D is the distance in miles from the reference point. This formula does not correct for the effect of refraction of the radio wave.

56. Rapid Calculation of Expected Range

The communication range of Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), or Radio Relay Set AN/TRC–4(*), with or without Amplifier Equipment AN/TRA–1(*), over an unobstructed path can be estimated quickly without mathematical computations by using figure 51. The following facts must be known to make use of figure 51: the height in feet of both the transmitting and the receiving antennas above the average level of the intervening terrain, the types of transmitting and receiving antennas being used, and the r-f power

Table IV. Conversion of Sea Level Elevations to Line-of-Sight Elevations

D (miles from reference point)	Elevation correction (ft) (K=1)
2	3
4	11
6	24
8	43
10	67
12	96
14	131
16	171
18	216
20	267
22	323
24	384
26	451
28	523
30	600
32	683
34	771
36	864

output of the transmitter. This nomograph will not give accurate results for transmission paths over very high hills or mountains, but reasonable approximations may be made by careful selection of the antenna height reference level, considering the height of the intervening hills and their distance from the transmitting and receiving locations.

a. Explanation of Scales.

(1) *Antenna height (HT and HR) scales.* For transmission paths over flat or gently rolling terrain or over sea water, the values of antenna heights used should be the height of the center of the antenna above the average level of the intervening terrain. If the transmitting or receiving antenna is located on top of a high hill with comparatively flat lowland in the transmission path, add the elevation of the hill above the average terrain level to the height of the antenna mast.

(2) *Scale A.* This scale is arranged midway between the HT and HR scales to calculate automatically the average height of the transmitting and receiving antennas.

(3) *Set and antenna combination scales.* The value of power used has been calculated as power in watts delivered to the antenna multiplied by the transmitter antenna gain; it is based on the signal strength required for multichannel operation.

(4) *Range-in-miles scale R.* Resulting reliable range in miles is obtained directly from the calibration of this scale.

b. Use of Nomograph (fig. 51). To determine the expected range, place a straight edge between the point on the transmitting antenna height scale, HT, and the point on the receiver antenna height scale, HR, corresponding to the transmitter and receiver antenna heights, respectively. Hold a pencil or other sharp object at the point of intersection of the straight edge

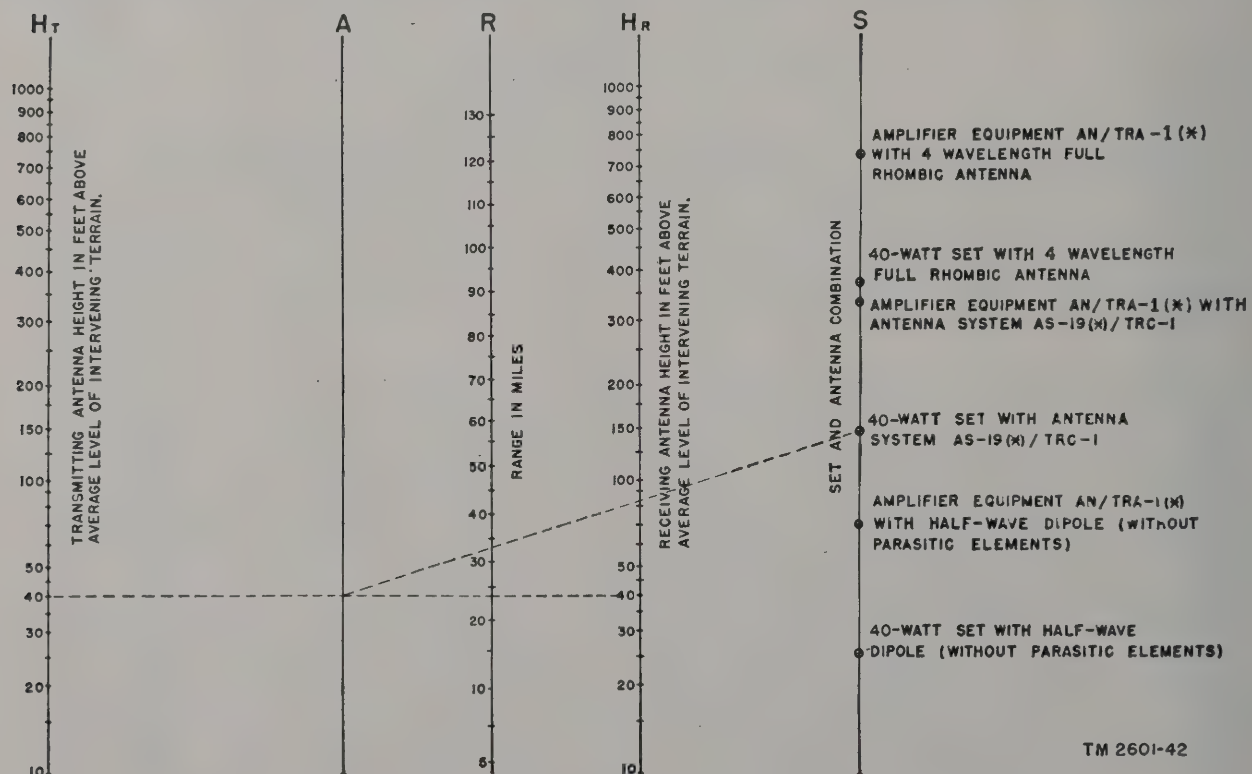


Figure 51. Nomograph for calculating approximate maximum range of radio relay equipment.

with scale A. Then place the straight edge between this point on scale A and the point on the set and antenna combination scale S corresponding to the existing set and antenna combinations. Read the expected range from range scale R at its point of intersection with the straight edge.

Note. Scale S assumes that similar antennas are used for transmitting and receiving. The example shown by the broken lines on the chart illustrates its use in the following situation:

Transmitting antenna height, 40 feet.
Receiving antenna height, 40 feet.
Transmitter power, 40 watts.
Transmitting Antenna System AS–19 (*) /TRC–1.
Receiving Antenna System AS–19 (*) /TRC–1.
Approximate range, 33 miles.

57. Noise and Interference

The range of v-h-f equipment is inversely related to the amount of noise or interference at the receiver location; the more noise or interference present, the shorter the distance that can be spanned satisfactorily. The most objectionable result of high noise level is reduced intelligibility in telephone circuits and errors in carrier telegraph circuits. Industrial plants using electrical equipment, radio transmitters, power lines, motor vehicle ignition systems, hospital equipment, and power units are sources of radio noises. Harmonic radiation from other transmitters may cause considerable interference. The prime requirement for good communication is a high signal-to-noise ratio. SET UP ALL RECEIVING EQUIPMENT AWAY FROM ALL MOTOR TRAFFIC, AND DO NOT PERMIT VEHICLES TO COME WITHIN 200 YARDS OF RECEIVER ANTENNAS.

58. Accessibility of Proposed Site

Accessibility of a proposed site and a good transmission path are equally necessary. Reconnaissance is an important part in the planning of proposed communication sites. When choosing a location, access by vehicles to supplies of gasoline, water, oil, and food should be considered, as well as the ability to transport the radio equipment to and from the proposed site.

59. Summary of Siting

a. Use line-of sight paths.

b. Avoid locating close to motor roads, telephone and power lines, industrial plants, radio transmitters, hospitals, or gasoline engines.

c. Draw a profile to determine whether the proposed path is line of sight.

d. Determine the accessibility of a proposed location by reconnaissance.

e. Erect antennas sufficiently high to clear nearby trees, buildings, and other obstacles.

f. Make a test set-up of proposed circuit.

60. Location of Antenna

The exact location of the antenna will depend on the length of the proposed transmission (distance between stations), the nature of local and intervening terrain, and the tactical situation.

a. RECONNAISSANCE. The planning of v-h-f radio communication systems and the selection of sites for installation of the radio sets should always be preceded by a careful study of terrain maps and, wherever possible, by reconnaissance. Detailed information will then be available concerning the nature of the terrain and the accessibility of desirable sites. This is particularly important when the proposed communication system requires the installation of intermediate relay stations in isolated areas.

(1) *Requirements.* Assembly and erection of each antenna requires a clearing 50 feet wide and 65 feet long. The site should be chosen so that all the antennas are grouped together and are reasonably close to the receivers and transmitters. After a suitable site has been found, the ground plan should be studied to select the best location for the antenna mast base (fig. 55). During assembly, the antenna lies on the ground in the 65-foot length of clear space.

(2) *Terminal station.* A terminal station requires two antennas, one for receiving and one for transmitting. The mast bases are spaced 100 feet apart. Therefore, a clearing 150 by 65 feet is required to prevent overlapping of the guy wires. Antennas pointing in the same direction should be located side by side, not one behind the other.

(3) *Relay station.* A relay station requires four antennas usually arranged to

form a square. Therefore, a 150-foot square is necessary to prevent the guy wires from overlapping. The transmitting and receiving antennas must not face each other.

b. HEIGHT. With the same antenna height, longer distances can be spanned when transmitting over water or level ground than over hills. Conversely, when transmitting over the same type of terrain, longer distances can be spanned by increasing the height of the transmitting or receiving antenna or both. Using the standard antennas provided with the sets, the average distance to be expected over flat terrain is 25 miles.

c. WOODED AREAS. Distances covered may be less than average where the antenna is located in a heavily wooded area or in a jungle. In such situations, the antenna should be placed as high as possible above the trees or in the open on the edge of the woods toward the distant station so that the immediate foreground in that direction is free of trees or other obstructions. Figure 52 illustrates antenna siting in wooded areas and gives a rough measure of the performance to be expected with various antenna locations.

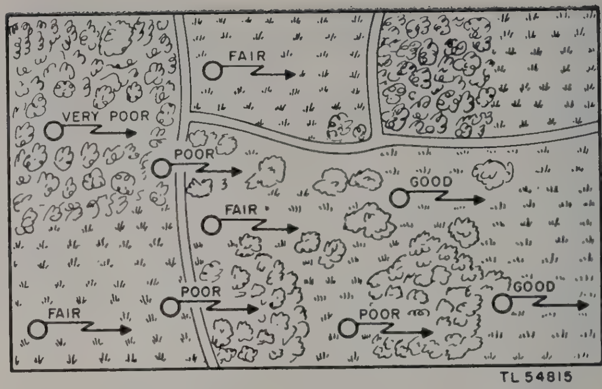
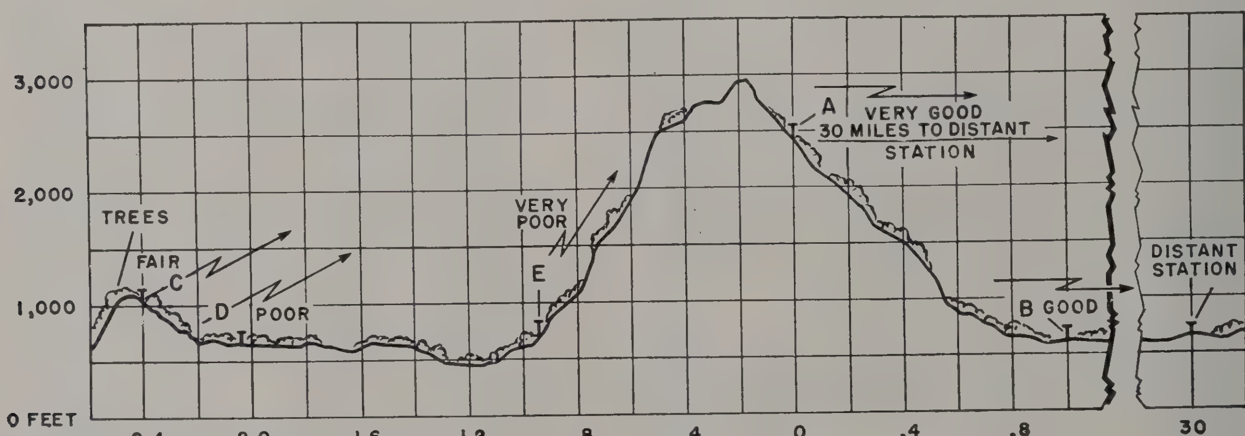


Figure 52. Location of antenna in flat wooded areas.

d. LATERAL MOVEMENT. In situations where weak signals result, investigation should be made of the proximity of trees, buildings, telephone lines, or power lines. Weak signals often result from reflection or absorption by such objects. Under these conditions, lateral movement of the antenna 50 to 200 feet may improve the signal strength considerably. The length of coaxial transmission line used should be kept to a minimum.



RELATIVE SIGNAL STRENGTH

LOCATION	PERCENT RELATIVE TO LOCATION A
A	100 (REFERENCE)
B	25
C	10
D	2
E	1

TM 2601-44

Figure 53. Location of antenna in hilly areas.

e. HILLS. In hilly or mountainous terrain, the distance which can be covered depends on the care with which the antenna sites are selected.

(1) If a careful selection is made, the presence of hills may be an advantage rather than a handicap. Under extremely favorable conditions, where line-of-sight communication can be had from mountaintop to mountaintop, it may be possible to span distances in excess of 50 miles. In such long transmission, however, fading of signals may be experienced. If a poor selection is made, intervening hills may block line-of-sight transmission. Although the radio waves bend to a certain extent over such an obstruction, this bending is always accompanied by a loss in signal strength; the greater the bending, the greater the loss. This loss can be minimized by locating the antennas on hills high enough to provide a line-of-sight path or by choosing, for both ends of the system, locations which involve the least bending of the waves to clear the obstructions. In general, the distance between the antenna and the nearest hill in the direction of the transmission should not be less than 2 miles.

(2) Figure 53 illustrates antenna siting in hilly country and indicates the relative signal strength to be expected from different antenna locations. In many cases, particularly in mountainous country where advantage is taken of natural elevations, it will not be necessary to erect the antenna mast to its maximum height in order to obtain satisfactory signal strength. If line-of-sight transmission is achieved with the sites selected, the use of masts made up of four or five sections and one set of guy ropes will usually provide a satisfactory antenna height. If communications must be established quickly over short distances well within line of sight, the reflector or the director elements, or both, may be removed from Antenna AS–20(*)/TRC–1 to provide a satisfactory dipole antenna. This practice will simplify installation, lessen the danger of breakage, and facilitate concealment from visual enemy observation. However, if many of the channels in the 70- to 100-mc range are being used, removing the director or reflector elements may cause avoidable local interference. The probability of enemy interception due to the change in the antenna emission pattern should also be considered.

61. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment refer to paragraph 117.

a. GENERAL. Equipment may be shipped in oversea packing cases, in domestic packing cases, or, sometimes, in its own carrying cases. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient for the permanent or semipermanent installation of the equipment. The instructions in subparagraph *b* below apply to equipment shipped in export packing cases and the instructions in subparagraph *f* below to equipment in domestic packing cases. Aside from checking to make sure that all carrying cases are present and that the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in carrying cases (fig. 2). Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or the circuit portions are exposed to the elements, a complete overhaul might be required, or the equipment might be rendered useless.

b. STEP-BY-STEP INSTRUCTIONS FOR UNCRATING AND UNPACKING EXPORT SHIPMENTS (figs. 6 through 10 and 54).

(1) Place the packing cases as near the operating or final installation position as is convenient.

(2) Cut and fold back the steel straps.

(3) Remove the nails with a nail puller. Remove the top and then one side of the packing case. Do not attempt to pry off the sides and bottom; the equipment may become damaged.

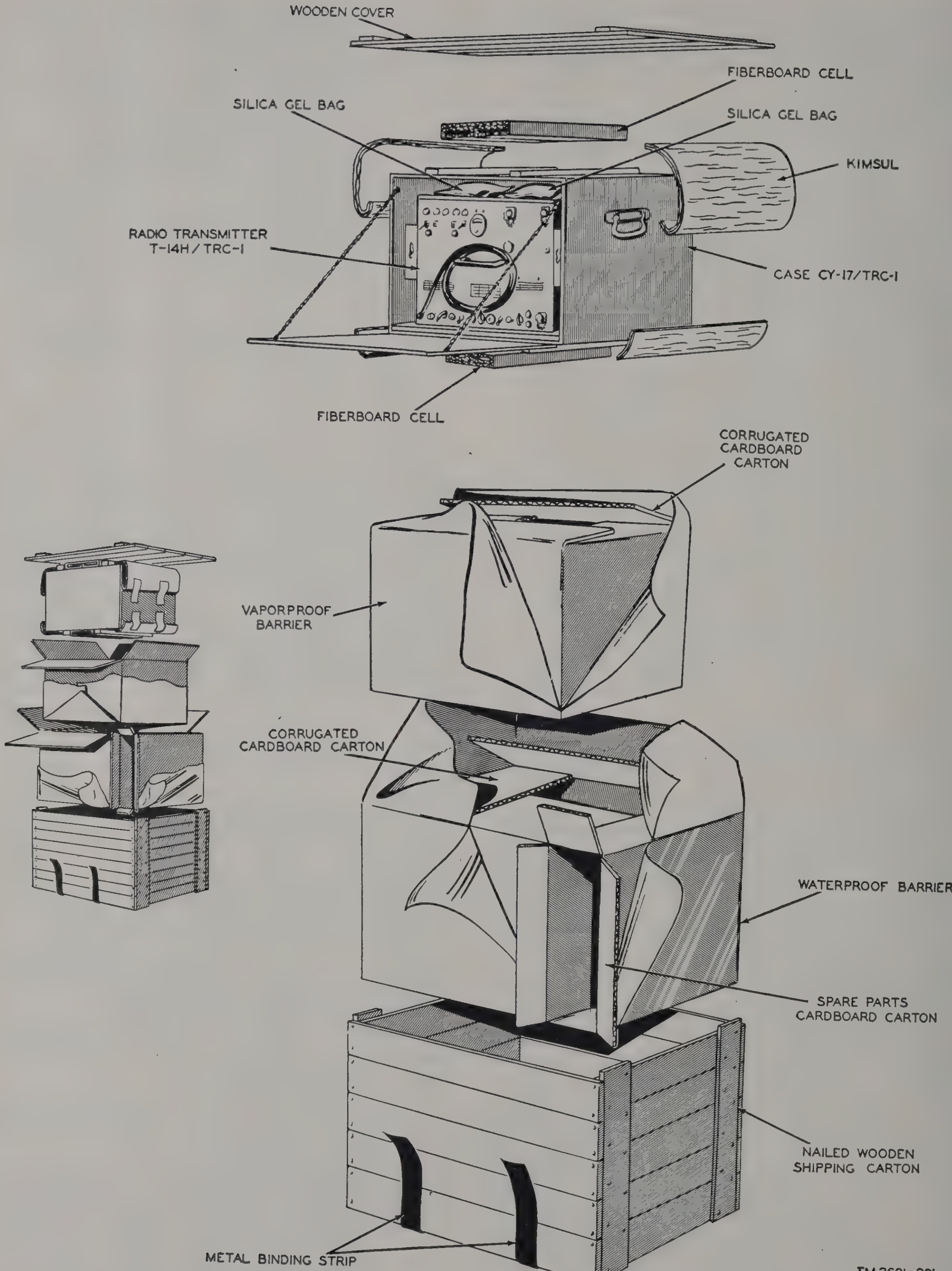


Figure 54. Typical component packed for export shipment.

(4) Remove the waterproof metal container or moistureproof barrier and the excelsior or corrugated paper covering the equipment inside the case. See subparagraph *d* below for instructions on removing the waterproof metal container. Be careful, when removing waterproofing and protective wrappings, not to remove any moistureproofing and fungiproofing coatings.

(5) Remove the equipment from its inner case and place it on the workbench or near its final location.

(6) Inspect the equipment for possible damage incurred during shipment.

c. OPENING CARDBOARD CARTON AND WATERPROOFING BARRIER. Be careful when removing outer wrappings. No special instructions are needed for opening the waterproof paper barrier and removing cardboard cartons.

d. INSTRUCTIONS FOR OPENING METAL CONTAINERS. The top of the metal container is soldered to the sides. To open the container, break the soldered seam by prying the side of the container away from the soldered seam as follows:

(1) Wipe off the excess solder with a soldering iron. Never use a torch because the contents of the container are inflammable.

(2) With a wooden block or screw driver, pry the sides from the soldered seam.

(3) When the seam is completely open, pry off the cover.

(4) Remove the bags of desiccant and the protective cardboard packing, and lift out the contents.

e. CHECKING. Check the contents of the packing cases against the master packing slip or against individual case packing slips.

f. UNPACKING DOMESTIC PACKING CASES. Radio equipment may be received in domestic packing cases. The instructions given in *b* above also apply to unpacking domestic shipments. Cut the metal bands. Open the cartons that protect the equipment, or, if heavy wrapping paper has been used, remove it carefully and remove the contents. Check the contents of the packing case against the master packing slip.

Note. Save the original packing cases and containers from both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment to base maintenance repair shops.

Section II. INSTALLATION OF ANTENNA SYSTEM AS–19(*)/TRC–1

62. Unpacking Antenna System

a. For domestic shipment, all pieces of antenna equipment are transportable in their own cases; special unpacking instructions are not required (par. 61*a*). Antenna System AS–19(*)/TRC–1, although composed of many individual components (app. III), can be broken down into two major portions: the antenna with its r-f connection cables and the mast with its stakes, guy ropes, and base. These two major components, with all the accessories and running spares needed for each, have been separated and packed in cases for ease of transportation and handling.

b. The unlettered, A, B, and C models of Antenna System AS–19(*)/TRC–1 are packed in two cases, Cases CY–29(*)/TRC–1 and CY–30(*)/TRC–1. Check all items against the lists of each case.

c. In the early procurements of Antenna System AS–19F/TRC–1, the two major components and all of the accessories and running spares needed for each are packed in four cases, one canvas bag, and a carrying frame for ease of transportation and handling. Check all items against the lists located on the exteriors of the cartons and inside Case CY–790/TRC–1.

d. In the D and E models and later procurements of the F model of the antenna system, the two major components and all of the accessories and running spares needed for each are packed in one Case CY–444/TRC–1, one Carrying Frame CY–445/TRC–1, four Cases CY–443/TRC–1, and two canvas Bags BG–102–(*) for ease of transportation and handling. Check items against lists located on the exteriors of cartons and inside Case CY–444/TRC–1.

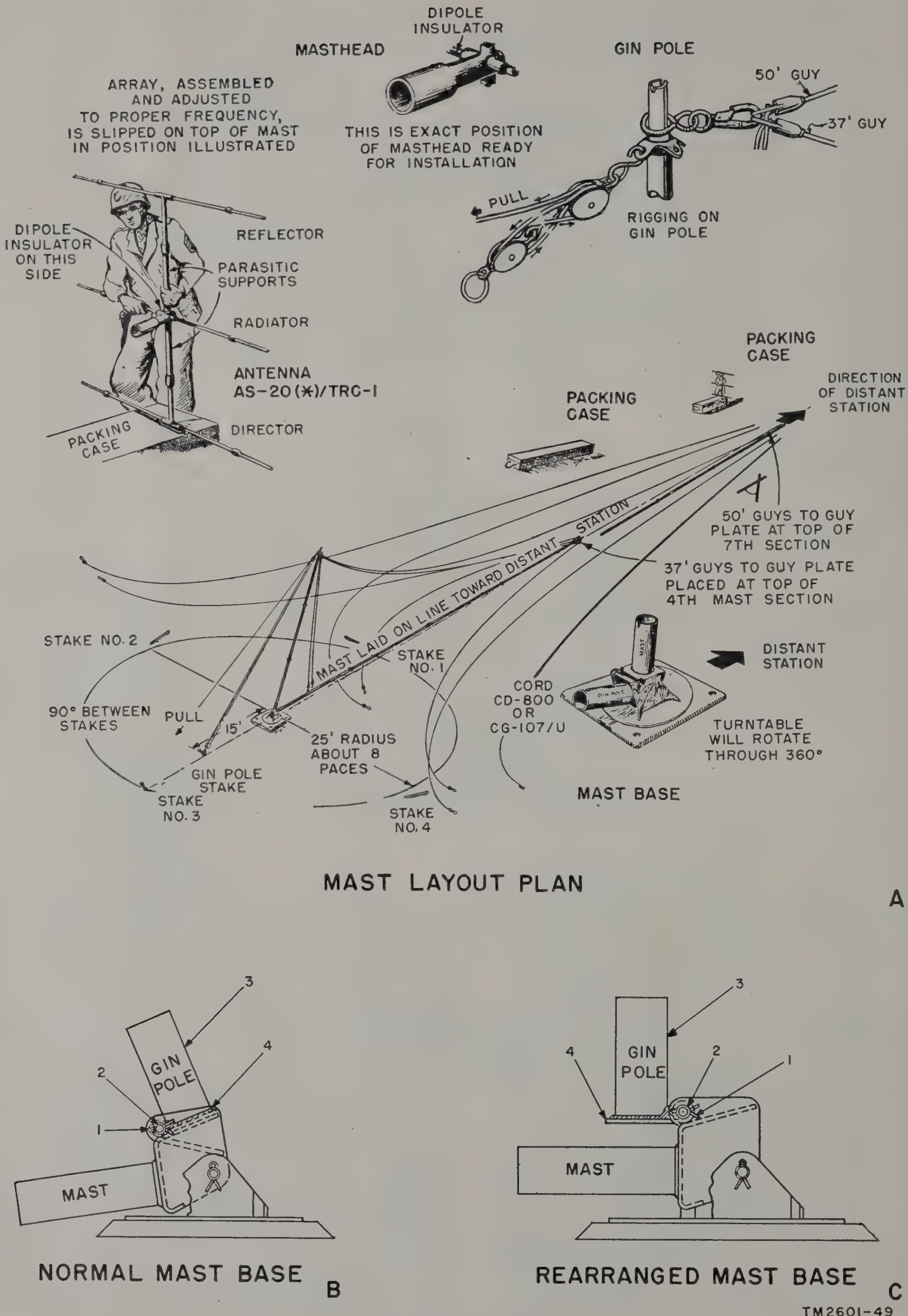


Figure 55. Antenna System AS-19(*)/TRC-1, ground plan and parts layout for 40-foot mast.

63. Assembly of Antenna Support AB-33(*)/TRC-1

a. Select the location of the antenna mast base after studying the ground plan in figure 55. Place a rock or any other suitable marker on this spot, and carry Case CY-29(*)/TRC-1 (or Cases CY-443/TRC-1, Carrying Frame CY-445/TRC-1, and Bag BG-102-(*)) approximately 7 paces in the direction of the distant station. Place the equipment out of the way about 5 paces to the left of the line that the mast will occupy. Walk about 7 more paces on the line toward the distant station and place either Case CY-30(*)/TRC-1, Case CY-790/TRC-1, or Case CY-444/TRC-1 and the other Bag BG-102-(*) (depending on the model of antenna system supplied) at that point.

b. Remove the component parts of Antenna Support AB-33(*)/TRC-1 from the packing case (or cases). Figures 8 and 17 illustrate typical packaging of the antenna system components. Locate the components approximately as shown in figure 55. Keep all mast section ends and threaded parts out of mud and sand.

(1) The following parts are needed for erecting a complete 40-foot mast assembly:

- 8 mast sections for mast
- 3 mast sections for gin pole
- 1 mast base
- 5 Stakes GP-25 (4 for unlettered model)
- 4 Stakes GP-2 (4 carriage bolts for unlettered model)
- 3 guy plates (2 for unlettered model)
- 4 guys 50 feet long (3 guys 60 feet long for unlettered model)
- 4 guys 37 feet long (3 guys 40 feet long for unlettered model)
- 1 Hammer HM-3, double-faced, 8-pound

(2) In addition to the items listed in (1) above, the following items are required:

(*a*) For Antenna Support AB-33/TRC-1:

- 1 block, pulley, double-sheave, 3-inch.
- 1 block, pulley, single-sheave, 4-inch with hook and becket.
- 1 150-foot length of rope 3/8-inch, for making up tackle.
- 1 Hammer HM-1, double-faced, 2-pound.

(*b*) For Antenna Support AB-33A/TRC-1:

- 1 block, pulley, double-sheave, 1½-inch.
- 1 block, pulley, single-sheave, 1½-inch.
- 1 150-foot length of rope 3/8-inch, for making up tackle.
- 1 S-hook.
- 1 scissors horse.
- 1 Hammer HM-1, double-faced, 2-pound.

(*c*) For Antenna Support AB-33B/TRC-1 and early models (40-foot) of Antenna Support AB-33C/TRC-1:

- 1 block and tackle assembly.
- 5 stake ring and snap assemblies.
- 1 scissors horse.
- 1 Hammer HM-2, double-faced, 4-pound.

(3) For Antenna Support AB-33C/TRC-1 (50-foot) procured on Order No. 1621-Phila-49 or 24689-Phila-49, the following items are needed:

- 10 mast sections for mast.
- 3 mast sections for gin pole.
- 4 guy plates; 3 for vertical mast, 1 for gin pole.
- 4 guys 50 feet long.
- 4 guys 37 feet long.
- 4 guys 60 feet long.
- 1 Mast Base AB-102/TRC-1.
- 5 Ring-Snap Assemblies MX-553/TRC-1.
- 4 Stakes GP-2 (used with mast base).
- 5 Guy Stakes GP-108/U (4 guy stakes, 1 gin pole stake).
- 1 block and tackle assembly.
- 1 Hammer HM-3.

c. The axe needs to be removed from the chest only for clearing underbrush. The star

drill is for making guy-stake holes in rocky locations, in which case four Stakes GP–2 are used instead of Stakes GP–25, which are used in soft ground. Carriage bolts are furnished with the unlettered model in place of Stakes GP–2. In rocky locations, a fifth Stake GP–2 (carriage bolt for unlettered model) is used in one of the mast base holes to prevent the mast base from sliding. In soft ground, four Stakes GP–2 (four carriage bolts for unlettered model) are used in the mast base.

64. Assembly of Antenna AS–20(*)/TRC–1

a. Remove the component parts (figs. 5 and 17) of Antenna AS–20(*)/TRC–1 from their case.

(1) The following parts are needed from Case CY–30(*)/TRC–1 to make up an early type of antenna array:

- 6 dipole elements.
- 2 parasitic support members.
- 1 antenna masthead.
- 1 roll of Tape TL–83, friction.
- 1 roll of Tape TL–94, rubber.
- 1 Cord CD–800 or CG–107/U, 50-foot.
- 1 wrench, double-end, 1⅛ inch and ¾-inch (2 wrenches, open-end, 1⅛-inch and ¾-inch, with Antennas AS–20A/TRC–1 and AS–20B/TRC–1).

(2) For Antenna AS–20F/TRC–1, the following parts are needed from Case CY–790/TRC–1, or Case CY–444/TRC–1 and Bag BG–102–(*):

- 6 dipole antenna elements.
- 1 antenna element support.
- 1 masthead support (aluminum casting).
- 1 to 3 mast extensions.
- 1 Cord CD–800 or CG–107/U, 65-foot.
- 1 Plug PL–258.
- 1 Tag MC–72.
- 1 roll of Tape TL–83, friction.
- 1 roll of Tape TL–192, rubber.
- 1 wrench, double-ended, open type, ¾-inch and ⅞-inch.

Caution: Keep all threaded parts out of mud and sand. Handle coaxial cable without sharply kinking or bending it. Do not step on it. Do not drive vehicles over it. Keep all Cord CD–800 or

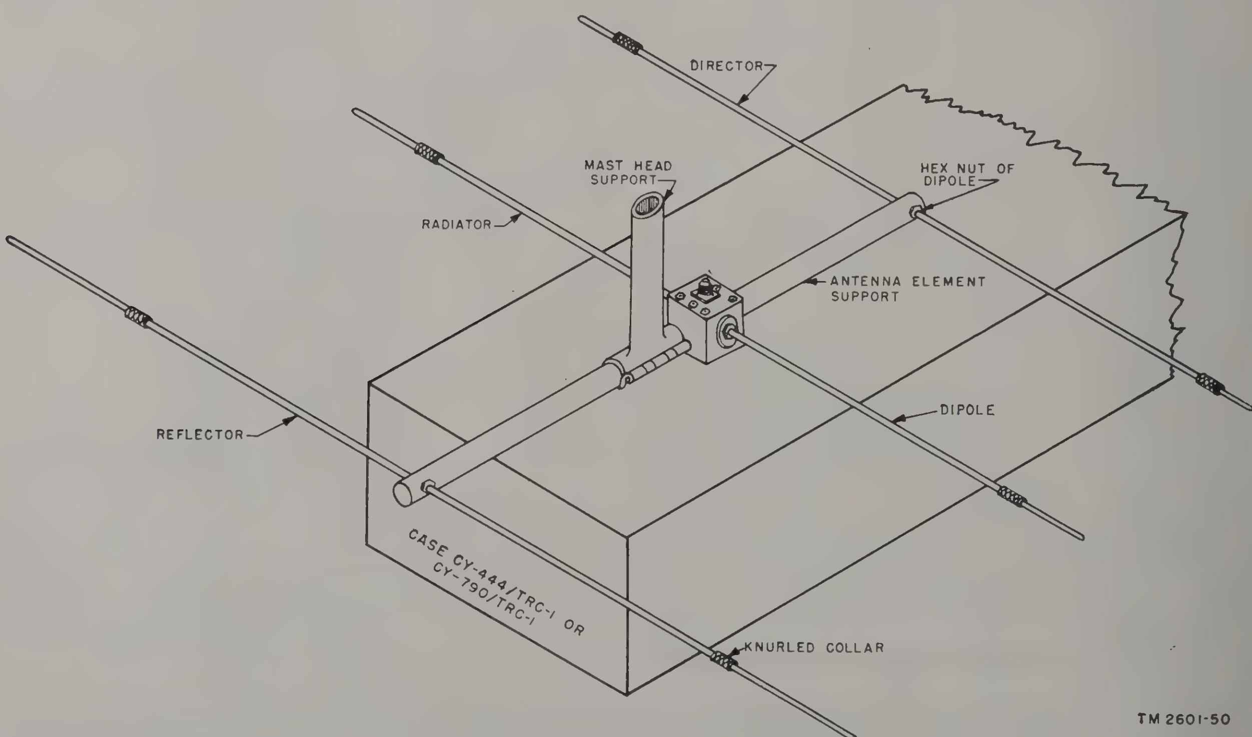


Figure 56. Assembly of Antenna AS–20/TRC–1.

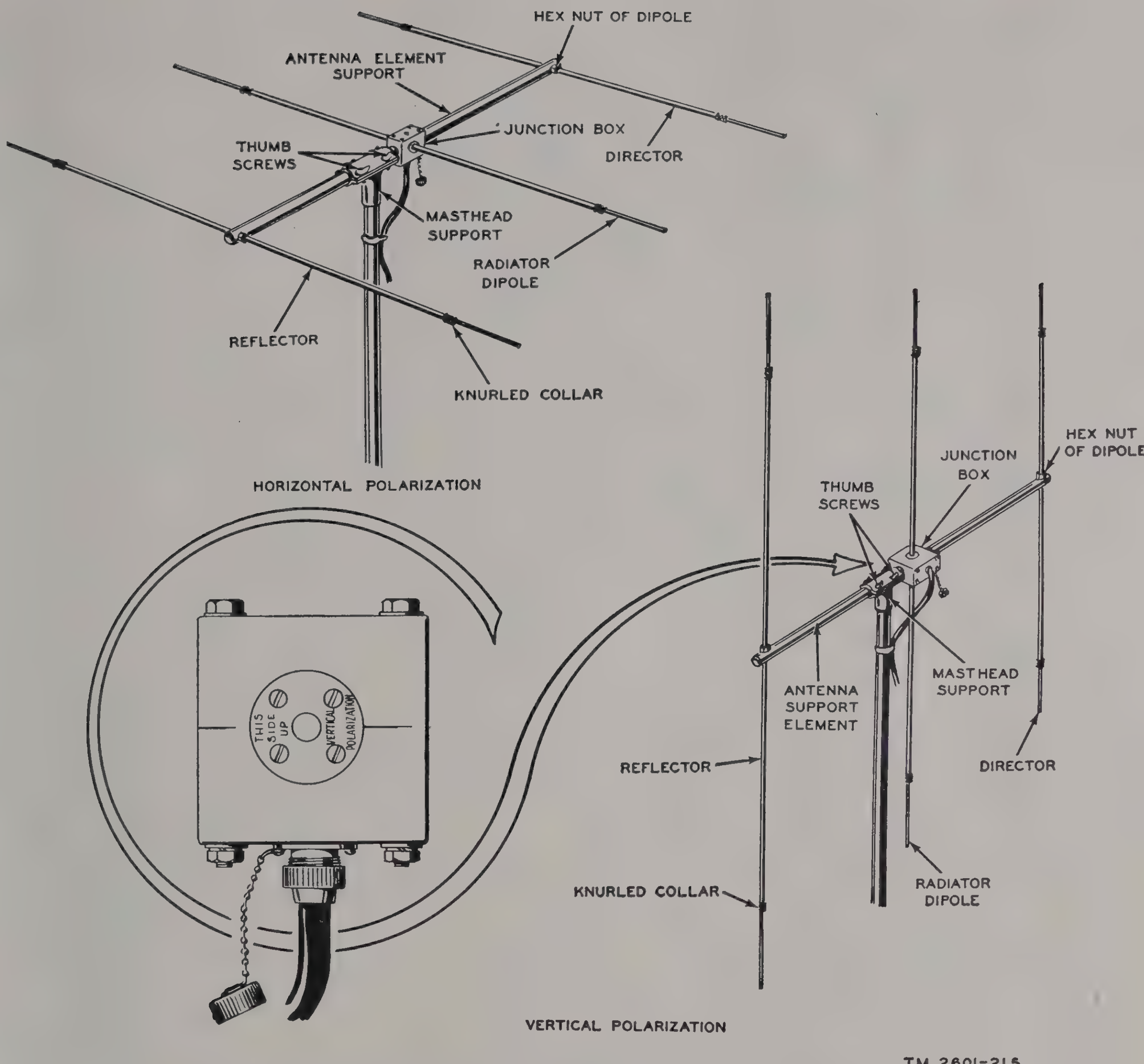


Figure 57. Horizontal and vertical polarization of Antenna AS–20F/TRC–1.

CG–107/U fittings and connectors absolutely dry.

b. Using a packing case as a platform to keep the components out of mud or dirt, assemble the array as shown in figure 56. First assemble the parasitic element supports to the masthead and tighten them by means of the larger wrench opening. Next screw in the six dipole elements as shown in figures 56 and 57. Tighten by means of the smaller wrench opening. Because of the thin tubular construction of Antenna AS–20(*)/TRC–1, the use of pliers or forcible twisting by hands on element tubes may cause damage. Tighten or loosen the members of this unit with open-end wrenches on hexagonal surfaces only. Never unscrew a parasitic element support by using the dipole element in it for a lever. Such a practice may bend the element or twist the support.

c. When assembling late models of Antenna AS–20F/TRC–1, use Case CY–444/TRC–1 or CY–790/TRC–1 as a working platform. First, attach the masthead support (aluminum casting) to the antenna element support and tighten securely by means of the wingnuts on the hinged clamp (fig. 57). Next, install the six dipole ele-

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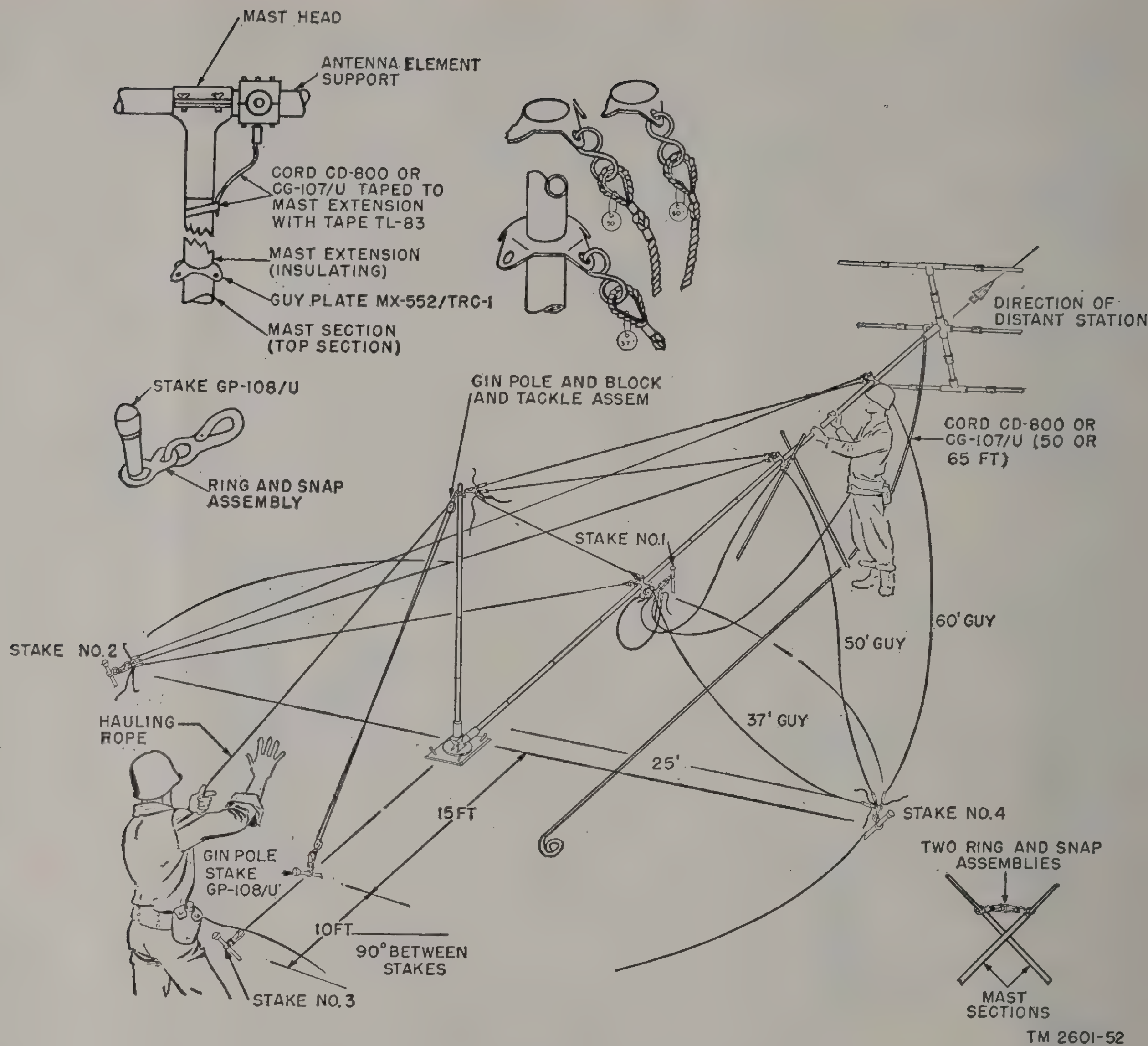


Figure 58. Assembly of Antenna System AS–19F/TRC–1.

ments and tighten by means of the smaller wrench opening. If vertical polarization is desired, install the antenna element support as marked *(this side up for vertical polarization)* (fig. 57).

65. Adjustment of Antenna AS–20(*)/TRC–1

Antenna AS–20(*)/TRC–1 provides maximum signal strength in transmitting and receiving when its three dipoles are properly adjusted. Study of antenna adjustment table V and manipulation of a dipole element should make rapid adjustment possible. The best plan to be followed in adjusting Antenna AS–20(*)/TRC–1 to the frequency of the transmitter or receiver with which it is to operate is explained below.

a. For all models of Antenna AS–20(*)/TRC–1 prior to Order No. 1621–Phila–49 (of Antenna AS–20F/TRC–1):

(1) Find frequency in column 1 of table V.

(2) Read across the page to the director column (4).

Table V. Antenna Element Length Settings

1	2	3	4	5	6	7	8
Channel frequency (mc)	Transmitter crystal frequency (kc)	Receiver crystal frequency (kc)	Set director elements to	Set insulated dipole element to	Set grounded dipole element to	Set reflector elements to	Set both parasitic support members to
70.0	729.167	7500.0	13¾	15¾	13½	17½	17
70.1	730.208	7510.0	13¾	15¾	13½	17½	17
70.2	731.250	7520.0	13¾	15½	13¼	17½	17
70.3	732.292	7530.0	13½	15½	13¼	17¼	16¾
70.4	733.333	7540.0	13½	15½	13	17¼	16¾
70.5	734.375	7550.0	13½	15½	13	17¼	16¾
70.6	735.417	7560.0	13½	15½	13	17¼	16¾
70.7	736.458	7570.0	13½	15¼	13	17	16¾
70.8	737.500	7580.0	13½	15¼	13	17	16¾
70.9	738.542	7590.0	13¼	15¼	12¾	17	16½
71.0	739.583	7600.0	13¼	15¼	12¾	17	16½
71.1	740.625	7610.0	13¼	15	12¾	17	16½
71.2	741.667	7620.0	13¼	15	12¾	16¾	16½
71.3	742.708	7630.0	13¼	15	12½	16¾	16¼
71.4	743.750	7640.0	13	15	12½	16¾	16¼
71.5	744.792	7650.0	13	15	12½	16¾	16¼
71.6	745.833	7660.0	13	14¾	12½	16½	16¼
71.7	746.875	7670.0	13	14¾	12½	16½	16
71.8	747.917	7680.0	13	14¾	12¼	16½	16
71.9	748.958	7690.0	12¾	14¾	12¼	16½	16
72.0	750.000	7700.0	12¾	14½	12¼	16½	16
72.1	751.042	7710.0	12¾	14½	12	16¼	16
72.2	752.083	7720.0	12¾	14½	12	16¼	16
72.3	753.125	7730.0	12½	14½	12	16¼	15¾
72.4	754.167	7740.0	12½	14½	12	16	15¾
72.5	755.208	7750.0	12½	14¼	12	16	15¾
72.6	756.250	7760.0	12½	14¼	12	16	15½
72.7	757.292	7770.0	12½	14¼	11¾	16	15½
72.8	758.333	7780.0	12¼	14¼	11¾	16	15½
72.9	759.375	7790.0	12¼	14	11¾	16	15½
73.0	760.417	7800.0	12¼	14	11¾	15¾	15½
73.1	761.458	7810.0	12¼	14	11½	15¾	15¼
73.2	762.500	7820.0	12¼	14	11½	15¾	15¼
73.3	763.542	7830.0	12	14	11½	15¾	15¼
73.4	764.583	7840.0	12	14	11½	15½	15¼
73.5	765.625	7850.0	12	13¾	11½	15½	15¼
73.6	766.667	7860.0	12	13¾	11¼	15½	15
73.7	767.708	7870.0	12	13¾	11¼	15½	15
73.8	768.750	7880.0	11¾	13¾	11¼	15½	15
73.9	769.792	7890.0	11¾	13½	11¼	15½	15
74.0	770.833	7900.0	11¾	13½	11	15¼	14¾
74.1	771.875	7910.0	11¾	13½	11	15¼	14¾
74.2	772.917	7920.0	11¾	13½	11	15¼	14¾
74.3	773.958	7930.0	11½	13½	11	15	14¾
74.4	775.000	7940.0	11½	13½	11	15	14¾
74.5	776.042	7950.0	11½	13½	11	15	14½
74.6	777.083	7960.0	11½	13¼	10¾	15	14½
74.7	778.125	7970.0	11½	13¼	10¾	15	14½
74.8	779.167	7980.0	11¼	13¼	10¾	14¾	14½
74.9	780.208	7990.0	11¼	13¼	10¾	14¾	14½
75.0	781.250	8000.0	11¼	13	10½	14¾	14¼

Table V. Antenna Element Length Settings—Continued

1	2	3	4	5	6	7	8
Channel frequency (mc)	Transmitter crystal frequency (kc)	Receiver crystal frequency (kc)	Set director elements to	Set insulated dipole element to	Set grounded dipole element to	Set reflector elements to	Set both parasitic support members to
75.1	782.292	8010.0	11¼	13	10½	14½	14¼
75.2	783.333	8020.0	11	13	10½	14½	14¼
75.3	784.375	8030.0	11	13	10½	14½	14¼
75.4	785.417	8040.0	11	13	10½	14½	14
75.5	786.458	8050.0	11	13	10½	14½	14
75.6	787.500	8060.0	11	12¾	10¼	14½	14
75.7	788.542	8070.0	11	12¾	10¼	14¼	14
75.8	789.583	8080.0	10¾	12¾	10¼	14¼	14
75.9	790.625	8090.0	10¾	12¾	10¼	14¼	14
76.0	791.667	8100.0	10¾	12¾	10¼	14¼	13¾
76.1	792.708	8110.0	10¾	12½	10	14	13¾
76.2	793.750	8120.0	10¾	12½	10	14	13¾
76.3	794.792	8130.0	10½	12½	10	14	13¾
76.4	795.833	8140.0	10½	12½	10	14	13½
76.5	796.875	8150.0	10½	12½	10	14	13½
76.6	797.917	8160.0	10½	12½	10	14	13½
76.7	798.958	8170.0	10½	12½	9¾	13¾	13½
76.8	800.000	8180.0	10½	12¼	9¾	13¾	13½
76.9	801.042	8190.0	10¼	12¼	9¾	13¾	13¼
77.0	802.083	8200.0	10¼	12¼	9¾	13¾	13¼
77.1	803.125	8210.0	10¼	12	9½	13½	13¼
77.2	804.167	8220.0	10¼	12	9½	13½	13¼
77.3	805.208	8230.0	10¼	12	9½	13½	13¼
77.4	806.250	8240.0	10	12	9½	13½	13
77.5	807.292	8250.0	10	12	9½	13½	13
77.6	808.333	8260.0	10	12	9½	13½	13
77.7	809.375	8270.0	10	12	9½	13¼	13
77.8	810.417	8280.0	10	11¾	9¼	13¼	13
77.9	811.458	8290.0	10	11¾	9¼	13¼	13
78.0	812.500	8300.0	9¾	11¾	9¼	13¼	12¾
78.1	813.542	8310.0	9¾	11¾	9¼	13¼	12¾
78.2	814.583	8320.0	9¾	11½	9	13	12¾
78.3	815.625	8330.0	9¾	11½	9	13	12¾
78.4	816.667	8340.0	9¾	11½	9	13	12¾
78.5	817.708	8350.0	9½	11½	9	13	12½
78.6	818.750	8360.0	9½	11½	9	13	12½
78.7	819.792	8370.0	9½	11½	9	13	12½
78.8	820.833	8380.0	9½	11¼	8¾	12¾	12½
78.9	821.875	8390.0	9½	11¼	8¾	12¾	12½
79.0	822.917	8400.0	9½	11¼	8¾	12¾	12¼
79.1	823.958	8410.0	9½	11¼	8¾	12¾	12¼
79.2	825.000	8420.0	9½	11	8½	12½	12¼
79.3	826.042	8430.0	9¼	11	8½	12½	12¼
79.4	827.083	8440.0	9¼	11	8½	12½	12¼
79.5	828.125	8450.0	9¼	11	8½	12½	12
79.6	829.167	8460.0	9¼	11	8½	12½	12
79.7	830.208	8470.0	9	11	8½	12½	12
79.8	831.250	8480.0	9	10¾	8½	12¼	12
79.9	832.292	8490.0	9	10¾	8¼	12¼	12
80.0	833.333	8500.0	9	10¾	8¼	12¼	11¾
80.1	834.375	8510.0	9	10¾	8¼	12¼	11¾

Table V. Antenna Element Length Settings—Continued

Table V. Antenna Element Length Settings—Continued

1	2	3	4	5	6	7	8
Channel frequency (mc)	Transmitter crystal frequency (kc)	Receiver crystal frequency (kc)	Set director elements to	Set insulated dipole element to	Set grounded dipole element to	Set reflector elements to	Set both parasitic support members to
80.2	835.417	8520.0	9	10¾	8¼	12¼	11¾
80.3	836.458	8530.0	9	10½	8¼	12	11¾
80.4	837.500	8540.0	8¾	10½	8	12	11¾
80.5	838.542	8550.0	8¾	10½	8	12	11½
80.6	839.583	8560.0	8¾	10½	8	12	11½
80.7	840.625	8570.0	8¾	10½	8	12	11½
80.8	841.667	8580.0	8¾	10½	8	12	11½
80.9	842.708	8590.0	8¾	10½	8	11¾	11½
81.0	843.750	8600.0	8½	10¼	8	11¾	11½
81.1	844.792	8610.0	8½	10¼	7¾	11¾	11½
81.2	845.833	8620.0	8½	10¼	7¾	11¾	11¼
81.3	846.875	8630.0	8½	10¼	7¾	11¾	11¼
81.4	847.917	8640.0	8½	10¼	7¾	11½	11¼
81.5	848.958	8650.0	8½	10	7¾	11½	11¼
81.6	950.000	8660.0	8½	10	7½	11½	11¼
81.7	851.042	8670.0	8½	10	7½	11½	11
81.8	852.083	8680.0	8¼	10	7½	11½	11
81.9	853.125	8690.0	8¼	10	7½	11½	11
82.0	854.167	8700.0	8¼	10	7½	11¼	11
82.1	855.208	8710.0	8¼	9¾	7½	11¼	11
82.2	856.250	8720.0	8¼	9¾	7½	11¼	11
82.3	857.292	8730.0	8	9¾	7½	11¼	10¾
82.4	858.333	8740.0	8	9¾	7¼	11¼	10¾
82.5	859.375	8750.0	8	9¾	7¼	11	10¾
82.6	860.417	7300.0	8	9¾	7¼	11	10¾
82.7	861.458	7308.3	8	9½	7¼	11	10¾
82.8	862.500	7316.7	8	9½	7¼	11	10½
82.9	863.542	7325.0	8	9½	7	11	10½
83.0	864.583	7333.3	8	9½	7	11	10½
83.1	865.625	7341.7	7¾	9½	7	11	10½
83.2	866.667	7350.0	7¾	9½	7	10¾	10½
83.3	867.708	7358.3	7¾	9¼	7	10¾	10½
83.4	868.750	7366.7	7¾	9¼	7	10¾	10½
83.5	869.792	7375.0	7¾	9¼	7	10¾	10¼
83.6	870.833	7383.3	7½	9¼	6¾	10¾	10¼
83.7	871.875	7391.7	7½	9¼	6¾	10¾	10¼
83.8	872.917	7400.0	7½	9¼	6¾	10½	10¼
83.9	873.958	7408.3	7½	9	6¾	10½	10¼
84.0	875.000	7416.7	7½	9	6¾	10½	10¼
84.1	876.042	7425.0	7½	9	6¾	10½	10
84.2	877.083	7433.3	7½	9	6½	10½	10
84.3	878.125	7441.7	7½	9	6½	10½	10
84.4	879.167	7450.0	7¼	9	6½	10½	10
84.5	880.208	7458.3	7¼	8¾	6½	10¼	10
84.6	881.250	7466.7	7¼	8¾	6½	10¼	10
84.7	882.292	7475.0	7¼	8¾	6½	10¼	9¾
84.8	883.333	7483.3	7¼	8¾	6½	10¼	9¾
84.9	884.375	7491.7	7¼	8¾	6½	10¼	9¾
85.0	885.417	7500.0	7	8½	6¼	10	9¾
85.1	886.458	7508.3	7	8½	6¼	10	9¾
85.2	887.500	7516.7	7	8½	6¼	10	9¾
85.3	888.542	7525.0	7	8½	6¼	10	9¾
85.4	889.583	7533.3	7	8½	6¼	10	9¾
85.5	890.625	7541.7	7	8½	6¼	10	9½
85.6	891.667	7550.0	7	8½	6	10	9½
85.7	892.708	7558.3	6¾	8¼	6	9¾	9½
85.8	893.750	7566.7	6¾	8¼	6	9¾	9½
85.9	894.792	7575.0	6¾	8¼	6	9¾	9½
86.0	895.833	7583.3	6¾	8¼	6	9¾	9¼
86.1	896.875	7591.7	6¾	8¼	6	9¾	9¼
86.2	897.917	7600.0	6¾	8¼	6	9¾	9¼
86.3	898.958	7608.3	6¾	8	5¾	9½	9¼
86.4	900.000	7616.7	6½	8	5¾	9½	9¼
86.5	901.042	7625.0	6½	8	5¾	9½	9
86.6	902.083	7633.3	6½	8	5¾	9½	9
86.7	903.125	7641.7	6½	8	5½	9½	9
86.8	904.167	7650.0	6½	8	5½	9½	9
86.9	905.208	7658.3	6½	7¾	5½	9½	9
87.0	906.250	7666.7	6½	7¾	5½	9½	9
87.1	907.292	7675.0	6½	7¾	5½	9¼	9
87.2	908.333	7683.3	6¼	7¾	5½	9¼	8¾
87.3	909.375	7691.7	6¼	7¾	5½	9¼	8¾
87.4	910.417	7700.0	6¼	7¾	5½	9¼	8¾
87.5	911.458	7708.3	6¼	7½	5½	9¼	8¾
87.6	912.500	7716.7	6¼	7½	5¼	9¼	8¾
87.7	913.542	7725.0	6	7½	5¼	9	8¾
87.8	914.583	7733.3	6	7½	5¼	9	8½
87.9	915.625	7741.7	6	7½	5¼	9	8½
88.0	916.667	7750.0	6	7½	5¼	9	8½
88.1	917.708	7758.3	6	7½	5¼	9	8½
88.2	918.750	7766.7	6	7½	5¼	9	8½
88.3	919.792	7775.0	6	7½	5	8¾	8½
88.4	920.833	7783.3	6	7¼	5	8¾	8½
88.5	921.875	7791.7	5¾	7¼	5	8¾	8¼
88.6	922.917	7800.0	5¾	7¼	5	8¾	8¼
88.7	923.958	7808.3	5¾	7¼	5	8¾	8¼
88.8	925.000	7816.7	5¾	7¼	5	8¾	8¼
88.9	926.042	7825.0	5¾	7¼	5	8½	8¼
89.0	927.083	7833.3	5¾	7	5	8½	8¼
89.1	928.125	7841.7	5¾	7	4¾	8½	8
89.2	929.167	7850.0	5½	7	4¾	8½	8
89.3	930.208	7858.3	5½	7	4¾	8½	8
89.4	931.250	7866.7	5½	7	4¾	8½	8
89.5	932.292	7875.0	5½	7	4¾	8½	8
89.6	933.333	7883.3	5½	7	4¾	8¼	8
89.7	934.375	7891.7	5½	6¾	4½	8¼	8
89.8	935.417	7900.0	5½	6¾	4½	8¼	7¾
89.9	936.458	7908.3	5½	6¾	4½	8¼	7¾
90.0	937.500	7916.7	5½	6¾	4½	8¼	7¾
90.1	938.542	7925.0	5¼	6¾	4½	8¼	7¾
90.2	939.583	7933.3	5¼	6¾	4½	8	7¾
90.3	940.625	7941.7	5¼	6½	4½	8	7¾

Table V. Antenna Element Length Settings—Continued

1	2	3	4	5	6	7	8
Channel frequency (mc)	Transmitter crystal frequency (kc)	Receiver crystal frequency (kc)	Set director elements to	Set insulated dipole element to	Set grounded dipole element to	Set reflector elements to	Set both parasitic support members to
90.4	941.667	7950.0	5¼	6½	4½	8	7½
90.5	942.708	7958.3	5¼	6½	4¼	8	7½
90.6	943.750	7966.7	5	6½	4¼	8	7½
90.7	944.792	7975.0	5	6½	4¼	8	7½
90.8	945.833	7983.3	5	6½	4¼	7¾	7½
90.9	946.875	7991.7	5	6½	4¼	7¾	7½
91.0	947.917	8000.0	5	6½	4¼	7¾	7½
91.1	948.958	8008.3	5	6¼	4	7¾	7½
91.2	950.000	8016.7	5	6¼	4	7¾	7¼
91.3	951.042	8025.0	4¾	6¼	4	7¾	7¼
91.4	952.083	8033.3	4¾	6¼	4	7¾	7¼
91.5	953.125	8041.7	4¾	6¼	4	7½	7¼
91.6	954.167	8050.0	4¾	6¼	4	7½	7¼
91.7	955.208	8058.3	4¾	6¼	4	7½	7¼
91.8	956.250	8066.7	4¾	6¼	4	7½	7
91.9	957.292	8075.0	4¾	6	4	7½	7
92.0	958.333	8083.3	4¾	6	3¾	7½	7
92.1	959.375	8091.7	4½	6	3¾	7½	7
92.2	960.417	8100.0	4½	6	3¾	7½	7
92.3	961.458	8108.3	4½	6	3¾	7½	7
92.4	962.500	8116.7	4½	6	3¾	7¼	7
92.5	963.542	8125.0	4½	6	3¾	7¼	7
92.6	964.583	8133.3	4½	6	3¾	7¼	6¾
92.7	965.625	8141.7	4½	6	3½	7¼	6¾
92.8	966.667	8150.0	4½	5¾	3½	7¼	6¾
92.9	967.708	8158.3	4½	5¾	3½	7	6¾
93.0	968.750	8166.7	4¼	5¾	3½	7	6¾
93.1	969.792	8175.0	4¼	5¾	3½	7	6¾
93.2	970.833	8183.3	4¼	5¾	3½	7	6½
93.3	971.875	8191.7	4¼	5¾	3½	7	6½
93.4	972.917	8200.0	4¼	5¾	3½	7	6½
93.5	973.958	8208.3	4¼	5½	3¼	7	6½
93.6	975.000	8216.7	4¼	5½	3¼	7	6½
93.7	976.042	8225.0	4¼	5½	3¼	7	6½
93.8	977.083	8233.3	4	5½	3¼	6¾	6½
93.9	978.125	8241.7	4	5½	3¼	6¾	6½
94.0	979.167	8250.0	4	5½	3¼	6¾	6¼
94.1	980.208	8258.3	4	5½	3	6¾	6¼
94.2	981.250	8266.7	4	5½	3	6¾	6¼
94.3	982.292	8275.0	4	5½	3	6¾	6¼
94.4	983.333	8283.3	4	5½	3	6½	6¼
94.5	984.375	8291.7	4	5¼	3	6½	6¼
94.6	985.417	8300.0	4	5¼	3	6½	6
94.7	986.458	8308.3	3¾	5¼	3	6½	6
94.8	987.500	8316.7	3¾	5¼	3	6½	6
94.9	988.542	8325.0	3¾	5¼	3	6½	6
95.0	989.583	8333.3	3¾	5¼	3	6½	6
95.1	990.625	8341.7	3¾	5¼	2¾	6½	6

Table V. Antenna Element Length Settings—Continued

1	2	3	4	5	6	7	8
Channel frequency (mc)	Transmitter crystal frequency (kc)	Receiver crystal frequency (kc)	Set director elements to	Set insulated dipole element to	Set grounded dipole element to	Set reflector elements to	Set both parasitic support members to
95.2	991.667	8350.0	3¾	5¼	2¾	6¼	6
95.3	992.708	8358.3	3¾	5	2¾	6¼	6
95.4	993.750	8366.7	3¾	5	2¾	6¼	6
95.5	994.792	8375.0	3½	5	2¾	6¼	5¾
95.6	995.833	8383.3	3½	5	2¾	6¼	5¾
95.7	996.875	8391.7	3½	5	2½	6¼	5¾
95.8	997.917	8400.0	3½	5	2½	6	5¾
95.9	998.958	8408.3	3½	5	2½	6	5¾
96.0	1000.000	8416.7	3½	5	2½	6	5¾
96.1	1001.042	8425.0	3½	5	2½	6	5½
96.2	1002.083	8433.3	3½	4¾	2½	6	5½
96.3	1003.125	8441.7	3½	4¾	2½	6	5½
96.4	1004.167	8450.0	3½	4¾	2½	6	5½
96.5	1005.208	8458.3	3¼	4¾	2½	6	5½
96.6	1006.250	8466.7	3¼	4¾	2½	6	5½
96.7	1007.292	8475.0	3¼	4¾	2¼	5¾	5½
96.8	1008.333	8483.3	3¼	4¾	2¼	5¾	5½
96.9	1009.375	8491.7	3¼	4¾	2¼	5¾	5½
97.0	1010.417	8500.0	3¼	4½	2¼	5¾	5¼
97.1	1011.458	8508.3	3¼	4½	2¼	5¾	5¼
97.2	1012.500	8516.7	3¼	4½	2¼	5¾	5¼
97.3	1013.542	8525.0	3	4½	2	5½	5¼
97.4	1014.583	8533.3	3	4½	2	5½	5¼
97.5	1015.625	8541.7	3	4½	2	5½	5¼
97.6	1016.667	8550.0	3	4½	2	5½	5¼
97.7	1017.708	8558.3	3	4½	2	5½	5
97.8	1018.750	8566.7	3	4½	2	5½	5
97.9	1019.792	8575.0	3	4½	2	5½	5
98.0	1020.833	8583.3	3	4¼	2	5½	5
98.1	1021.875	8591.7	3	4¼	2	5½	5
98.2	1022.917	8600.0	3	4¼	2	5¼	5
98.3	1023.958	8608.3	2¾	4¼	1¾	5¼	5
98.4	1025.000	8616.7	2¾	4¼	1¾	5¼	5
98.5	1026.042	8625.0	2¾	4¼	1¾	5¼	5
98.6	1027.083	8633.3	2¾	4¼	1¾	5¼	5
98.7	1028.125	8641.7	2¾	4¼	1¾	5¼	4¾
98.8	1029.167	8650.0	2¾	4	1¾	5¼	4¾
98.9	1030.208	8658.3	2¾	4	1¾	5	4¾
99.0	1031.250	8666.7	2¾	4	1¾	5	4¾
99.1	1032.292	8675.0	2¾	4	1½	5	4¾
99.2	1033.333	8683.3	2½	4	1½	5	4¾
99.3	1034.375	8691.7	2½	4	1½	5	4¾
99.4	1035.417	8700.0	2½	4	1½	5	4¾
99.5	1036.458	8708.3	2½	4	1½	5	4¾
99.6	1037.500	8716.7	2½	4	1½	5	4½
99.7	1038.542	8725.0	2½	4	1½	4¾	4½
99.8	1039.583	8733.3	2¼	3¾	1½	4¾	4½
99.9	1040.625	8741.7	2¼	3¾	1½	4¾	4½

(3) Loosen the knurled collars on both director elements (figs. 55 and 56). The director is the dipole which will be nearest to the distant station.

(4) Slide the outer tip of each dipole element of the director in or out, as the case may be, until its scale reads the value shown opposite the operating frequency in column 4 of the table. Tighten the knurled collars and make sure the tips will not move.

(5) Set the parasitic support member, on which the director is mounted, to the spacing shown opposite the operating frequency in column 8 of table V. This operation is illustrated in figure 55.

(6) Tighten the knurled collar firmly, as before, after making sure that the director elements are set parallel to the dipole elements which are screwed directly into the masthead.

(7) Screw two dipole elements into the masthead. The one screwed into the metal plate on the outside of the masthead insulator is called the insulated dipole element in the table. Set this to the length shown in column 5 of table V opposite the operating frequency and tighten the knurled collar.

(8) The remaining dipole element on the masthead is called the grounded dipole element. Set this to the length shown in column 6 of table V and tighten its collar.

(9) Set the rear parasitic support member to the same spacing used in (5) above. Tighten the collar after making sure that the reflector (or rear dipole) is lined up parallel to the director dipole and the masthead dipole.

(10) Consult column 7 in table V opposite the operating frequency, and set the two dipole elements of the reflector to the length found there. Remember that the reflector is the element furthest from the distant radio station. Tighten the knurled collars. Antenna AS–20(*)/TRC–1 is now completely adjusted for its frequency. It may be laid on Case CY–30(*)/TRC–1 until needed.

b. Components of late models of Antenna AS–20F/TRC–1 are shown in figure 40. For assembly of Antenna AS–20F/TRC–1, refer to figures 57 and 58. Do not use table V for antenna element length settings for late models of Antenna AS–20F/TRC–1; instead, use the following settings:

(1) If the operating frequency is between 70 and 83 mc, set each director to 8½, each radiator to 12, and each reflector to 19.

(2) If the operating frequency is between 83 and 100 mc, set the directors to 3¼, the radiators to 6, and the reflectors to 12.

66. Erection of Antenna System AS–19(*)/TRC–1

Caution: Do not kink coaxial cable. Any dents or sharp bends will ruin it. If either Cord CD–800 or CG–107/U is damaged, it should be replaced immediately.

a. Conditioning and Use of Nylon Guys. When Nylon guys are to be used, they should first be conditioned as follows:

(1) Fasten the S-hook of the guy rope to a nearby vehicle or tree.

(2) Unroll the rope to its full length and pull on it bodily to stretch it. A 60-foot guy rope should be stretched approximately 6 feet before use, a 50-foot guy, 5 feet, and a 37-foot guy, 4 feet.

(3) When using Nylon guys for mast-erecting operations, do not be afraid to stretch the ropes tightly. They are tensioned sufficiently by pushing the cord fasteners 2 to 4 feet further than is necessary to remove the initial slack.

(4) Nylon guys stretch much more than ordinary ropes. However, after the load is removed, they return to their original length. Wetness or dryness of guys does not affect their length.

b. Erecting 40-Foot Mast.

(1) Place the mast base in position. Do not drive Stakes GP–2 yet.

(2) If the mast base is assembled as shown in B, figure 55, rearrange it to the posi-

tion shown in C, figure 55. Rearrange the mast base as follows to avoid interference between the mast and gin-pole mounting plates (C, fig. 55):

(*a*) Remove the cotter pin from the end of the gin-pole swivel pin (item 1).

(*b*) Remove the gin-pole swivel pin (item 2), leaving the second cotter pin in place.

(*c*) Lift the gin-pole socket mounting plate (items 3 and 4), from its position, rotate it 180°, and drop it back into position.

(*d*) Replace the gin-pole swivel pin (item 2) and cotter pin (item 1).

(3) Measure off 25 feet or about 8 paces from the center of the mast base to locate Stakes GP–25, Nos. 1, 2, 3, and 4 (A, fig. 55). A doubled 50-foot guy looped over the mast base accurately locates all of these stakes at a distance of 25 feet from the base.

(4) Put snap-ring assemblies in place on each stake and drive it into the ground, leaving only 6 inches of their length above the ground. Tip the stakes outward a little from the mast base; they hold better in this position. Place a large S-hook on the snap ring of the No. 3 stake.

(5) Locate the position of the block-and-tackle gin-pole stake a distance of three mast sections from the mast base toward stake 3. Put a snap-ring assembly in place on the stake and drive the stake into the ground.

(6) Assemble three mast sections for the gin pole and place them on the ground pointing toward stake No. 4 (A, fig. 55). The ferruled end should point towards the stake. Slip a guy plate over the upper end of the gin pole.

(7) Tip the mast base on its right side looking towards the distant station, and place the base of the gin pole in its socket.

(8) Assemble four mast sections for the antenna and insert the proper end into the mast socket. The mast socket should be pointed towards the distant station. Place a guy plate over the end of the fourth section against the guy-plate sleeve located near the upper end of the section. Add three more sections and follow with another guy plate; then add one more mast section, completing the entire mast length. Fully engage the slots and pins of all sections so that it is impossible to rotate one section relative to another (fig. 59). Lift the top end of the mast off the ground and place the scissors horse (or a packing case) under the next to the top section.

(9) Unroll the guys and, if made of Nylon, condition them as outlined in (a) above. Attach the 37-foot and 50-foot guys to their respective guy plates on the mast (four of each guy at each guy plate). The 37-foot guys are used on the guy plate located at the top of the fourth mast section, and the 50-foot guys are used on the guy plate at the top of the seventh section.

(10) Lead the 37-foot guy that is to be the right-side guy to stake No. 4 (A, fig. 55). Repeat with the 50-foot guy on the right side of the mast. Attach the guy ring of each to the snap-ring assembly on stake No. 4. Attach the left-hand 37-foot and 50-foot guys to stake No. 2 in the same manner. Do not take up slack yet.

(11) Lay out the 37-foot and 50-foot back guys. Measure them against one of the side guys. Lead them clearly under all other ropes and fasten them to stake No. 1.

(12) Lead the 37-foot and 50-foot guys which will do the lifting to the snap-ring assembly on the gin pole. Fasten the guys to the snap-ring assembly by means of the S-hooks on the guys. The S-hooks are located 23 feet 6 inches from the snap-hook end of the 37-foot guys and 36 feet 9 inches from the snap-hook end of the 50-foot guys.

(13) While one man holds the mast in place (pointing toward the distant station), have a second man swing the outer end of the gin pole 3 feet toward

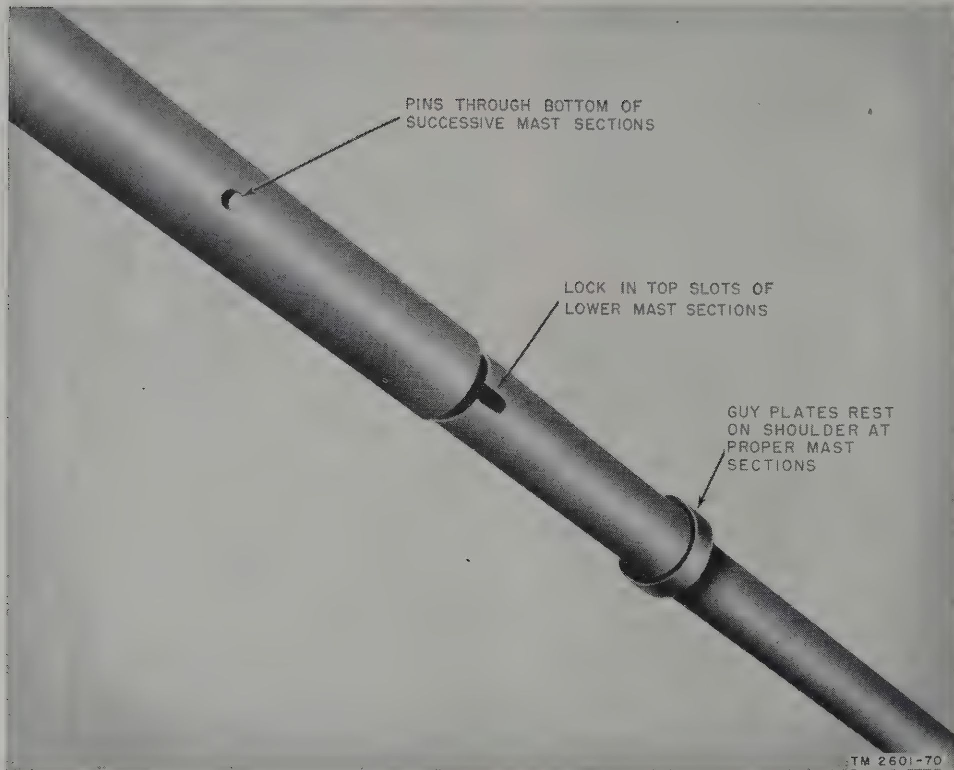


Figure 59. Detail of mast section lock.

the outer end of the mast, approximately a foot off the ground. If a rearranged mast base is being used, it will not be possible to swing the gin pole the full 3 feet without bending. Slight bending is permissible. Tighten the lifting ropes, without letting the mast or the gin pole move, until each is firmly tight. The longer rope should be tighter than the shorter one, if possible. When plucked, these ropes should vibrate almost like bow-strings.

(14) Attach the S-hook (or snap-hook) of the single-sheave pulley block to the guy plate on the gin pole. Attach the ring of the double-sheave pulley block to the snap-ring on the gin-pole stake.

(15) Walk the gin pole up to its original position without letting the mast base leave its original position. Take all the slack out of the block and tackle.

(16) Drive the four Stakes GP–2 through the holes in the mast base (fig. 60).

(17) Simultaneously tighten the two side guys on stakes No. 2 and No. 4, by means of Fasteners FT–9, until they are firmly and equally stretched. Adjust the length of the guys from stake No. 1 by moving Fasteners FT–9 to approximately the same positions as the fasteners on the other guys. Make certain that the mast, gin pole, and mast base remain in line during this operation.

(18) Check all guy lines and rigging to see that none are crossed or will tangle as the mast is raised. Then place the antenna array on top of the mast with the director elements parallel to and nearest the ground. Be sure to engage the masthead with the top mast section so that it is impossible to rotate the array on the mast. The specific procedure varies somewhat with the various models of Antenna System AS–19(*)/TRC–1.

(19) Carefully unroll one Cord CD–800 or CG–107/U (50- or 65-foot) and attach one end to the receptacle on the masthead. When the outer sleeve of

Figure 60. Staking down mast base.

Plug PL–259–(*) has been screwed firmly home on Socket SO–239, as shown in figure 61, wrap it thoroughly with Tape TL–94 to keep moisture out. Never allow Plugs PL–259–(*) on Cords CD–800 or CG–107/U to lie where moisture can get in them. Always tape them up when not in use.

(20) Tape Cord CD–800 or CG–107/U to the lower portion of the masthead (fig. 61) so as to place some slack between the taped portion and the masthead receptacle. This is to keep the 50- or 65-foot cable from hanging on the fragile connector.

(21) Place one man under the outer end of the mast and one in the center. Test the setting of the lifting ropes by pulling lightly on the block and tackle assembly. If high winds are blowing, station another man at the mast base to steady the gin pole. If the mast, with array attached, lifts cleanly, with a slight downward bend under the lower lifting rope, it is ready for raising. If not, readjust the lifting ropes. Never allow the gin pole to make a larger angle with the mast then 80° or 85° (slightly less than a right angle) when the weight of the mast is on the lifting ropes.

(22) When ropes are properly adjusted, raise the mast. The man stationed at the outer end of the mast to assist in the initial lifting operations should *never* move closer to the mast base than the outer end of the sixth mast section *while lifting*. When this part of the mast has been raised beyond his reach by the person handling the block and tackle, he should either let go or move rapidly inward to a point opposite the lower guy plate. At the same time he should reverse the lifting process to a

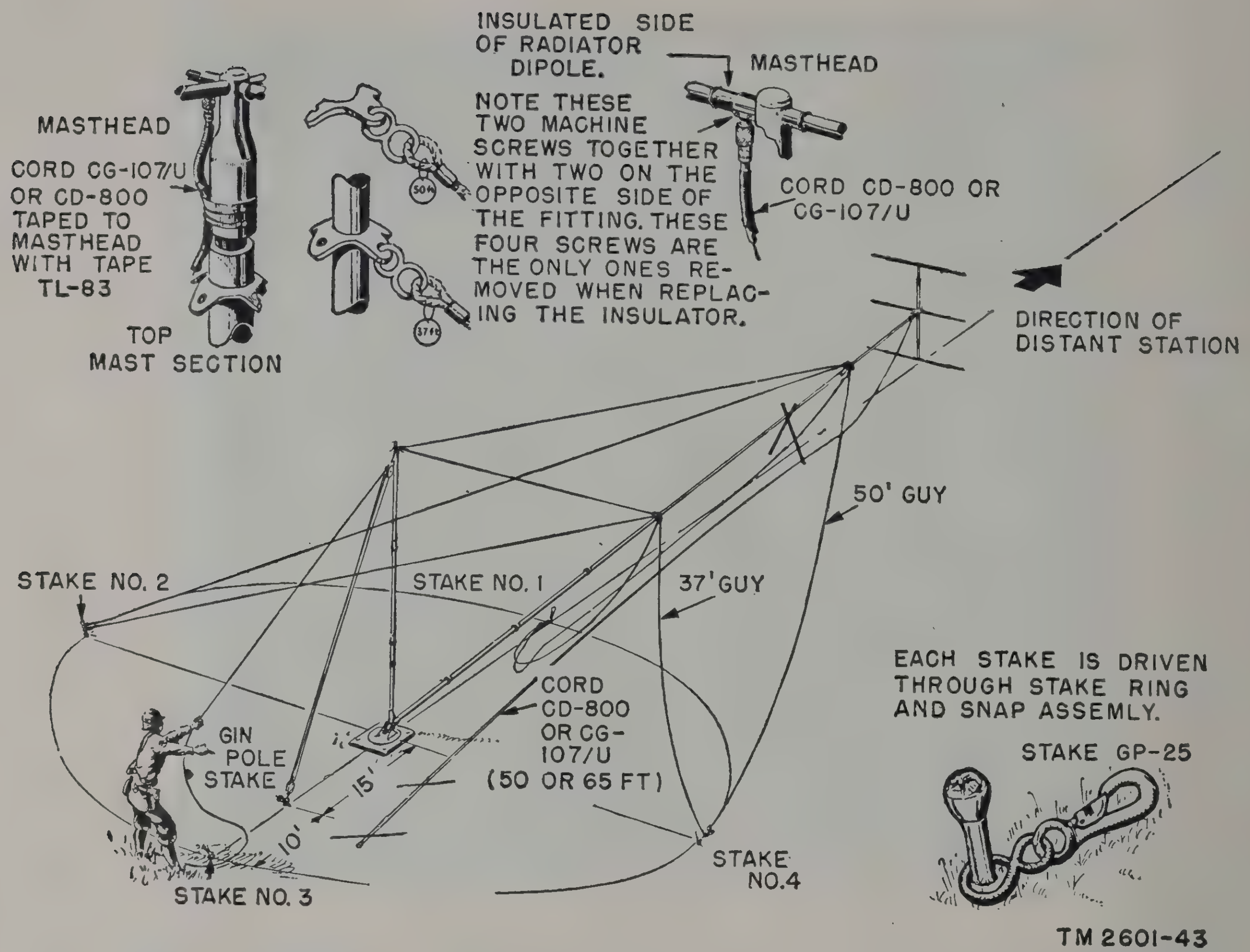


Figure 61. Antenna System AS–19B/TRC–1, assembly and raising.

downward pressure as he moves along the mast. *Lifting while opposite the lower guy plate, or while moving towards the lower guy will cause the mast to buckle upward at that point.* A downward pressure at the center, using the 37-foot back guy, if necessary, is beneficial. It tends to stretch the lower lifting rope the same amount that the upper rope is stretched by the weight of the mast. All masts should have a slight downward bend at the center during raising operations.

(23) When the mast becomes vertical, unhook the guys from the gin-pole guy plate and hook the rings on these guys over the large S-hook located on the No. 3 stake. During this transfer, prevent any slack from occurring in these two guys until they are securely placed over the S-hook. Remove slack from all guys. Tension them equally so that the mast is straight and vertical. Properly adjusted, the guys should almost sing when plucked.

(24) Remove the gin-pole guy plate from the gin-pole, but leave it attached to the block and tackle assembly to prevent its loss. Place the block and tackle next to the gin-pole guy stake, in a position ready for use when the mast is to be lowered. If it is a permanent or semipermanent installation, stow all loose items in Case CY–29(*)/TRC–1 or Bag BG–102–(*).

(25) The mast and antenna array can now

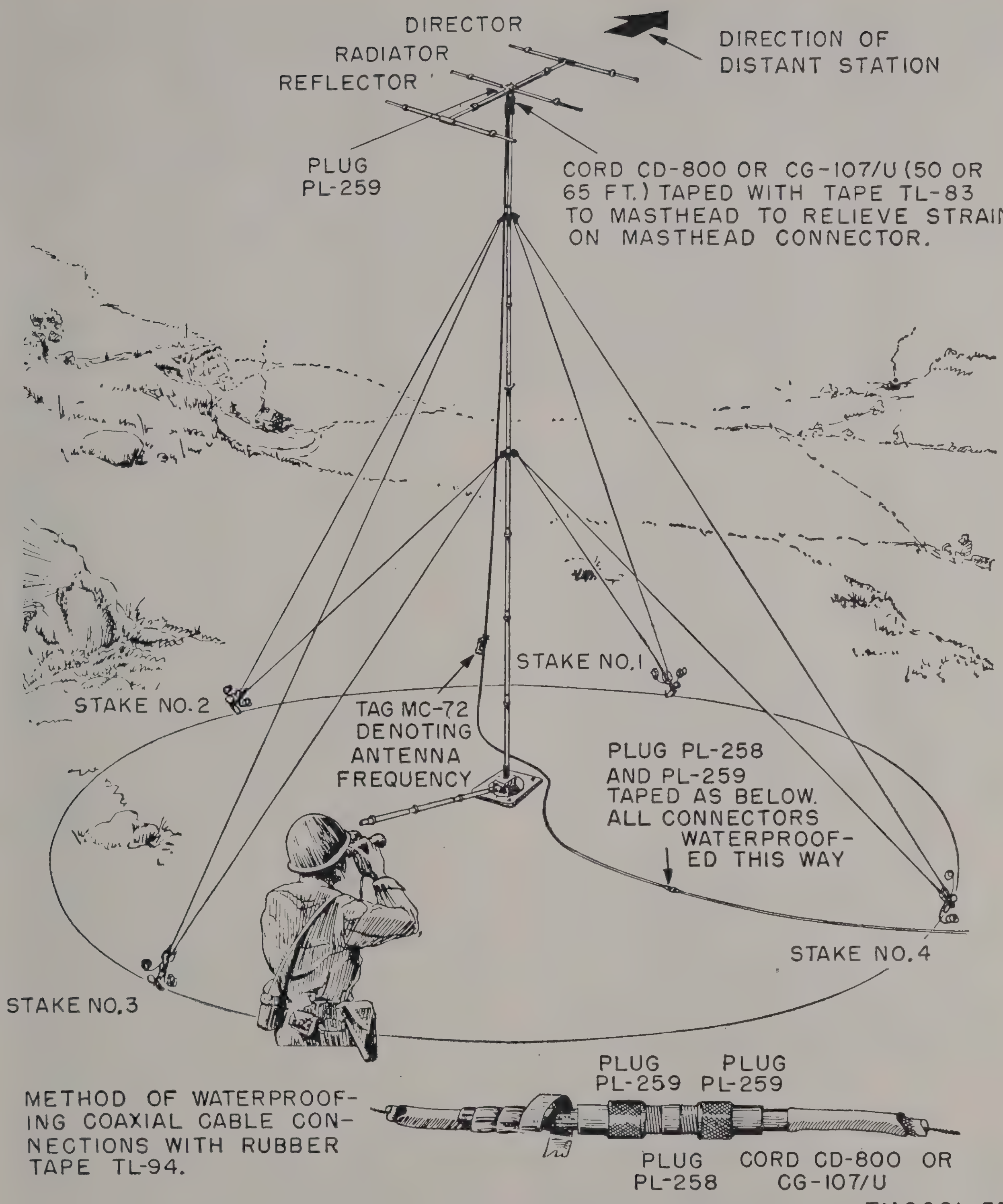


Figure 62. Antenna System AS–19(*)/TRC–1, using 40-foot mast, completely installed.

be rotated through 360° by using the gin-pole as a lever (fig. 62). This does not disturb the guys in any way, but Cord CD–800 or CG–107/U (50- or 65-foot) must be passed outside of each set of guys as each set is encountered.

(26) Mark one Tag MC–72 with the frequency of the antenna just erected and tie it about 5 feet off the ground (fig. 62) on the cord attached to the masthead.

(27) Install other Antenna Systems AS–19(*)/TRC–1 that use a 40-foot mast in the manner described above.

(28) Connect the plug on the bottom end of Cord CD–800 or CG–107/U (50- or 65-foot) to the ANTENNA connector on Radio Transmitter T–14(*)/TRC–1, the ANTENNA connector on Amplifier AM–8(*)/TRA–1, or the ANT. INPUT connector on Radio Receiver R–19(*)/TRC–1.

c. USING 50-FOOT MAST.

(1) Unroll the guys. Slip the ring end of a stake Ring-Snap Assembly MX–533/TRC–1 over each of four Guy Stakes GP–108/U. Drive the guy stakes 90° apart at a distance of 25 feet from the mast base. A 50-foot guy, doubled and looped around the mast base, may be used to locate the stakes properly. Slip the ring attached to the single-sheave end of the block and tackle assembly over that Guy Stake GP–108/U that is to be used with the gin pole. Drive the gin pole stake at a point three mast section lengths (15 feet) away from the mast base (fig. 58). Locate Mast Base AB–102/TRC–1 so that the engraved figures on the plate of the mast base coincide with true compass points (0° to north). Fasten the mast base with Stakes GP–2 (fig. 59).

(2) Tilt the sockets of the base toward the distant station, and assemble four mast sections, mating the correct end with the mast socket. Place a guy plate over the end of the fourth section against the guy-plate sleeve located near its upper end. Add three more mast sections. Install another guy plate, then the eighth, ninth, and tenth mast sections, and install another guy plate, thus completing the entire 50-foot mast length. Also assemble three sections for the gin pole. Place a guy plate over the upper end of the assembled gin pole. Slip the ring end of a stake ring and snap assembly over the guy plate. Fasten the hook of the double sheave pulley to the gin pole guy plate. Make sure that the slots and pins of all mast sections are fully engaged, so that it is impossible to rotate one mast section relative to another or relative to the mast base (fig. 60). Lift the top end of the mast off the ground, and place Case CY–444/TRC–1 or CY–790/TRC–1 under the eighth section (fig. 58).

(3) Fasten the bails of the Pul-tite clamps of one 37-foot guy, one 50-foot guy, and one 60-foot guy to each of the snaps of the stake ring and snap assemblies on stakes 1, 2, and 4 (fig. 58). By means of the special hook provided, attach the other end of each guy to the proper guy plate in the position shown in figure 58. Remove all slack from the guys leading to stakes 2 and 4 by means of the Pul-tite clamps, and adjust the length of the guys from stake 1 by placing the clamp in the same approximate position as on the corresponding sets of guys terminating on stakes 2 and 4.

(4) Next, rig the gin-pole, first placing it on the ground 90° from the antenna mast (pointing toward either stake 2 or stake 4) with the large diameter end at the mast base. By means of the bail on the Pul-tite clamp, connect the remaining 37-foot guy, 50-foot guy, and 60-foot guy (normally for stake 3) to the snap assembly at the top of the gin-pole. Attach the other ends of the three guys to the remaining holes in the guy plates on the mast. Each guy plate should now have four guys attached to it. Lift the gin pole assembly (three mast sections with attached block and tackle and antenna guys) into a vertical position, with respect to the mast. Insert the large end of the gin pole into the gin pole socket. Remove all slack from the antenna guys attached to the gin pole assembly by means of the Pul-tite clamps. Take

up the slack in the hauling rope of the block and tackle assembly. Check all guy lines and rigging to see that none are crossed or will tangle as the mast is raised.

(5) Install two of the plastic or fiberglass mast extensions over the end of the top mast section and next to the top guy plate. (One or two spare extensions are provided.) Install the masthead support (part of the assembled antenna array) on the top mast extension section. Make sure that the pin in the masthead seats in the slot in the mast extension section so that it is impossible to rotate the array with respect to the mast (fig. 60).

(6) Carefully unroll one Cord CD–800 or CG–107/U (65-foot) and attach Plug PL–259–(*) on one end to the socket on the antenna element support. When the outer sleeve of Plug PL–259–(*) has been screwed firmly to the masthead connector as shown in figures 61 and 62, wrap it thoroughly with rubber tape to keep moisture out. Never allow Plugs PL–259–(*) and Cords CD–800 or CG–107/U to lie where moisture can get in them. Always tape them when not in use.

(7) Tape Cord CD–800 or CG–107/U to the upper portion of the mast extension and to the lower portion of the masthead, so the weight of the 65-foot cable is removed from the fragile connector. Use Tape TL–83 for this operation. Waterproof the coaxial cable connections as shown in figure 62.

(8) The mast assembly is now complete and ready to be raised to the vertical position. While one man pulls on the hauling rope of the block and tackle assembly to raise the mast, another man should assist by walking toward the mast base under the mast and pushing the mast upward while walking. When the mast is in a vertical position, unhook the guys from the gin pole guy plate and fasten the bails of the Pul-tite clamps to the snap and ring assembly on stake 3. Do not permit any slack to occur in these three guys during the transfer until they are securely placed and equal tension is drawn on all of the guys. Remove the slack from all antenna guys, and tension them equally so that the mast is straight and vertical.

(9) Remove the gin pole guy plate from the gin pole but leave it attached to the block and tackle assembly to prevent its loss. Place the block and tackle next to the gin pole stake in a position ready for use when the mast is to be lowered. For semipermanent or permanent installations, replace the block and tackle assembly in Bag BG–102–(*).

(10) The mast and antenna array can now be rotated through 360° by using the gin pole as a lever. This does not disturb the guys in any way, but Cord CD–800 or CG–107/U must be passed outside of each set of guys as each set is encountered.

(11) Mark one Tag MC–72 with the frequency range of the antenna just erected, and tie it about 5 feet off the ground (fig. 63) on Cord CD–800 or CG–107/U attached to the masthead.

(12) Install other Antenna Systems AS–19(*)/TRC–1, using a 50-foot mast, in the manner described above.

(13) Connect the plug on the bottom end of Cord CD–800 or CG–107/U to the ANTENNA connector on Radio Transmitter T–14H/TRC–1, the ANTENNA connector on Amplifier AM–8(*)/TRA–1, or the ANT. INPUT connector on Radio Receiver R–19H/TRC–1.

67. Installation Summary

a. Whenever practicable, the radio set should be put in operation as near as possible to Antenna System AS–19(*)/TRC–1 to keep transmission line Cord CD–800 or CG–107/U short. Losses developed in this r-f cable when it is transmitting power can be considerable. If there is any choice, let the cord connected to the receiver be the longer one. In any case,

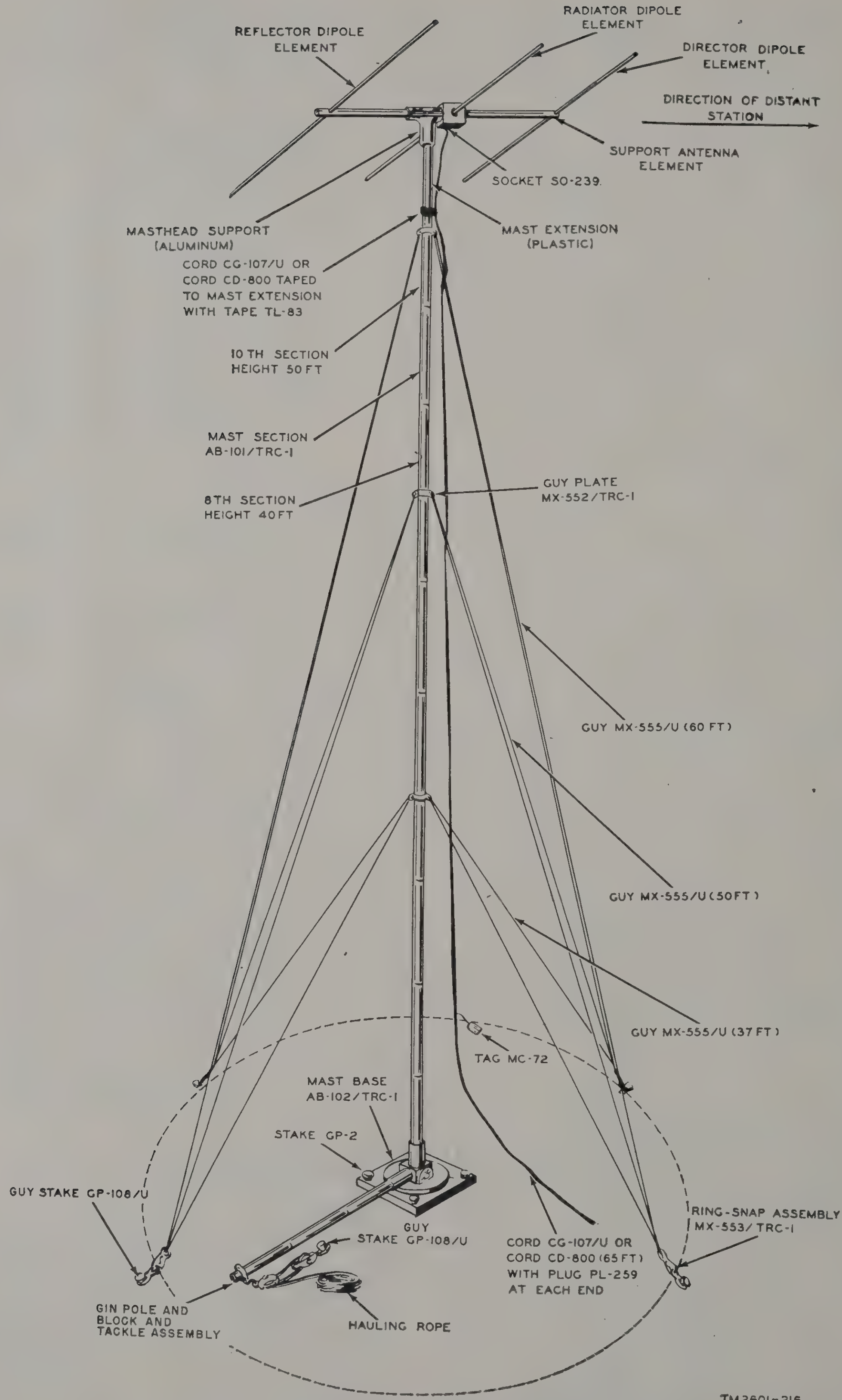


Figure 63. D, E, or F model of antenna system, erected.

never use more than three 50- or 65-foot lengths of Cord CD–800 or CG–107/U when transmitting or receiving.

b. When more than one Cord CD–800 or CG–107/U is to be used between the radio set and antenna, couple them together with Plug PL–258 which is provided with Antenna System AS–19(*)/TRC–1. Fasten the sleeves firmly and cover the complete coupling with rubber tape TL–94 (fig. 62).

c. When erecting masts on rocky surfaces, heavy rocks may be used for anchors instead of ground Stakes GP–25, Guy Stakes GP–108/U, or carriage bolts.

Section III. INSTALLING RHOMBIC ANTENNAS

68. General

This section describes the construction, installation, and adjustment of rhombic antennas for use with Radio Terminal Set AN/TRC–3(*) and Radio Relay Set AN/TRC–4(*), with or without Amplifier Equipment AN/TRA–1(*). Rhombic antennas may be used whenever average operating distances may have to be exceeded, when additional gain in signal strength is necessary, or where a signal-to-noise ratio, greater than that at a normal antenna, is required. Some supplementary gain is particularly necessary in terminal and relay applications where higher than normal attenuation may result in unsatisfactory multichannel communication.

a. REFERENCES. Information pertaining to the theory and operating principles of rhombic antennas in general can be obtained in TM 11–314.

b. MATERIAL. Materials required for fabrication of rhombic antennas for use with these equipments are authorized by MWO SIG 11–2601–4.

69. Application

a. Satisfactory communication can be obtained with these radio sets over average terrain of approximately 25 miles when using Antenna AS–20(*)/TRC–1 on its 40-foot mast. When greater range is necessary, as might be required by extended mountain chains, large bodies of water, impenetrable swamps, or enemy occupation, making 25-mile spacing of relay stations impracticable, one of the following must be increased:

(1) Height of the transmitting antenna.
(2) Height of the receiving antenna.
(3) Gain of the transmitting antenna (above the 6 db of Antenna AS–20(*)/TRC–1).
(4) Gain of the receiving antenna (above the 6 db of Antenna AS–20(*)/TRC–1).
(5) Power output of the transmitter to the antenna.
(6) Sensitivity of the receiver.

b. Since the power output of the transmitter (or of the transmitter and amplifier) and the sensitivity of the receiver are fixed by their design so that no improvement other than careful tuning can be made in the field, and since all antennas will be placed in as advantageous positions as possible, only the gain of the antenna systems can be improved. Correct use of the rhombic antenna (fig. 64) effectively quadruples the signal power in the desired direction over that normally transmitted by Antenna AS–20(*)/TRC–1, because the rhombic at the average height of 25 feet (measured from the ground to the terminating resistor) has an inherent gain of 6 db over Antenna AS–20(*)/TRC–1 at 40 feet (par. 66*b*).

c. In the same manner, another rhombic in place of Antenna AS–20(*)/TRC–1 at the distant receiver will quadruple the signal input power at that end. Thus, for any well-elevated line-of-sight transmission path and transmitter-receiver combination, two rhombics used in place of two Antennas AS–20(*)/TRC–1 will produce a signal level at the receiver which is comparable to one which would be received if the transmitter power were increased 16 times. Considerable gain (but less than 16 times) is also obtained when the rhombic is located on low terrain. This greatly increased signal strength will permit clear multichannel com-

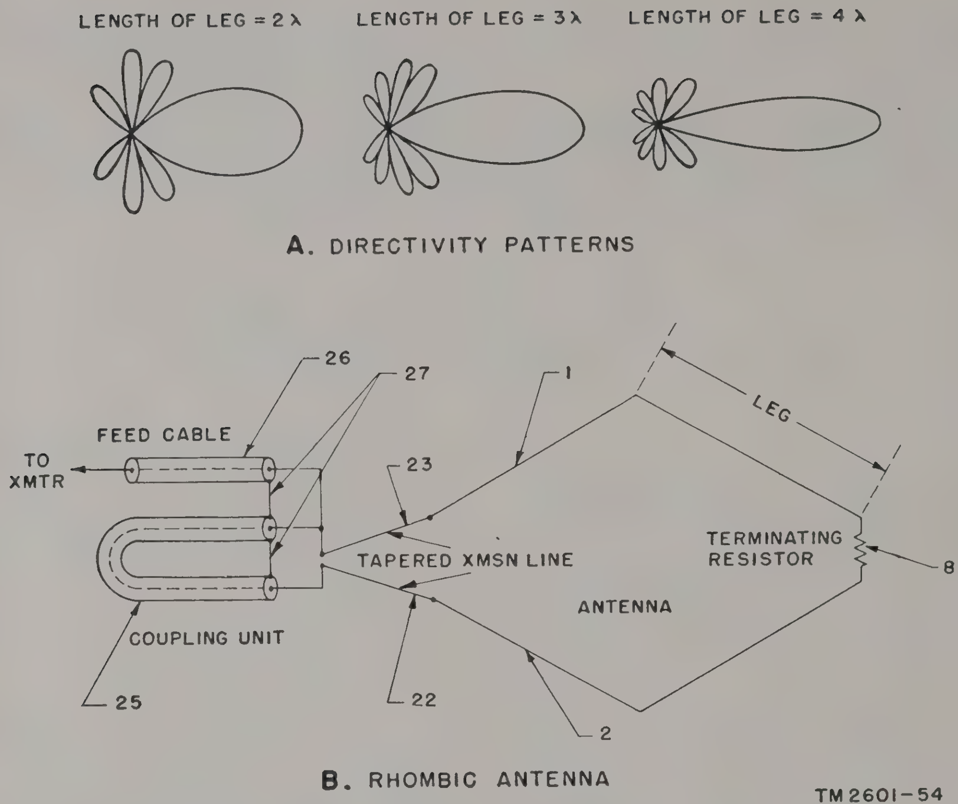


Figure 64. Rhombic antenna, circuit diagram showing directivity patterns.

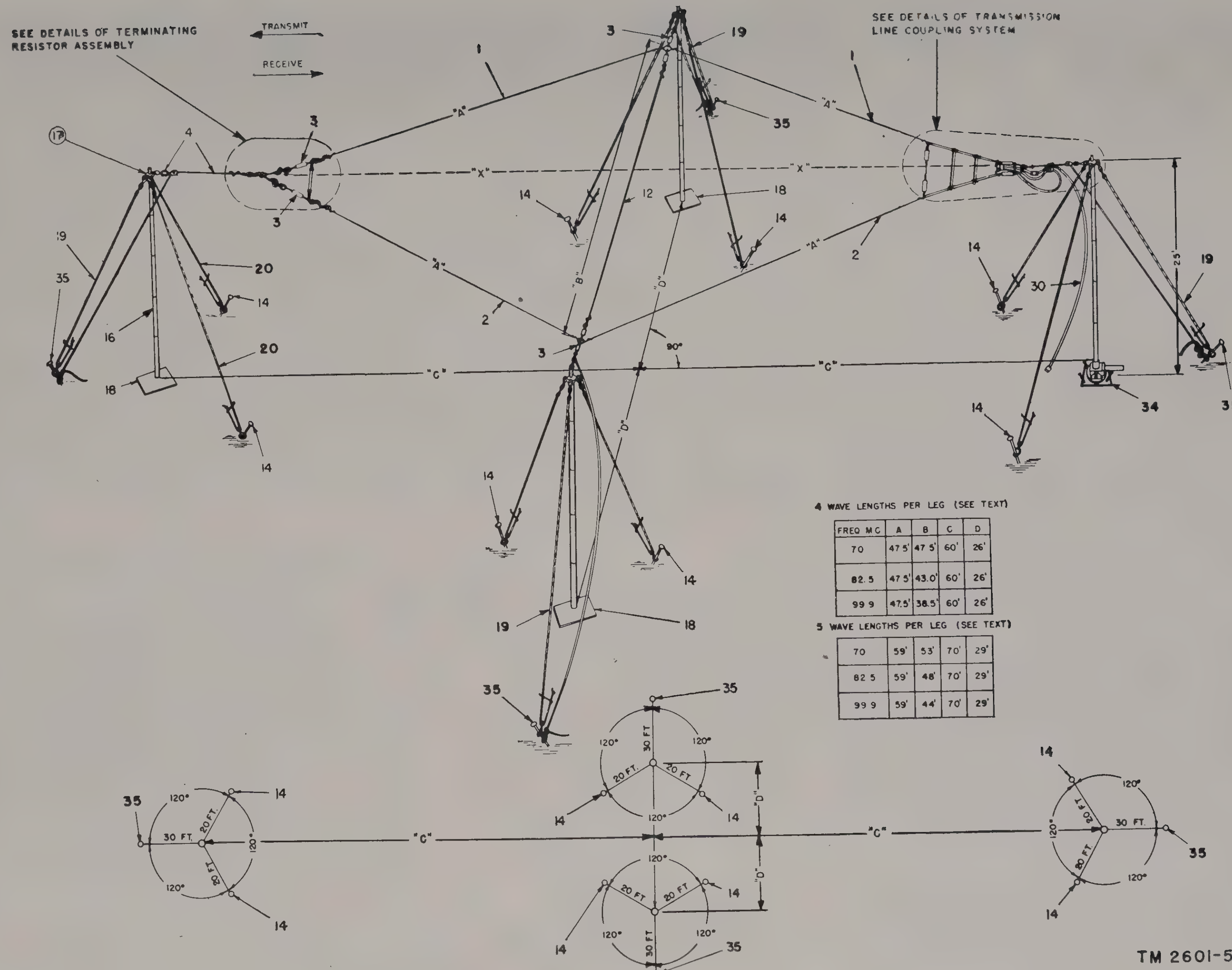
munication on many occasions when distances are so great that only weak, noisy, and fading signals are possible with the usual antenna equipment.

d. From the above, it can be seen that one easily constructed rhombic antenna per circuit (if *high* ground is available) will provide approximately the same increase in signal power as that normally obtained by the use of Amplifier Equipment AN/TRA–1(*). In addition, a rhombic installed at each end of the same circuit will produce a signal at the receiver four times greater than that obtained when using the amplifier and two Antennas AS–20(*)/TRC–1. Therefore, on circuits where weight and space in vehicles must be kept to a minimum, and yet considerable signal gain is required, the rhombic will prove exceedingly useful. Nevertheless, remember that Amplifier Equipment AN/TRA–1(*) serves two very important functions as follows: First, when foliage is so high and thick that a rhombic cannot be constructed as high as Antenna System AS–19(*)/TRC–1 (a rhombic thus hidden in the trees becomes comparatively useless), the only gain possible must be obtained from the amplifier. Second, some overwater jumps are so long that the amplifier must be used in conjunction with rhombics at both ends of the circuit for satisfactory operation.

70. Characteristics of Horizontal Rhombic

a. POLARIZATION. When erected horizontally, the horizontally polarized rhombic antenna will transmit or receive about the same signal over land as over sea and will pick up less man-made noise, including harmonic signal interference from vertical vehicular antennas in the neighborhood. In addition, it will operate satisfactorily in conjunction with a distant horizontal three-element array, such as Antenna AS–20(*)/TRC–1, on any flat terrain, low or otherwise. If high ground is available, the rhombic will give good results when erected 10 or 15 feet above the ground on fabricated wooden masts.

b. DIMENSIONS. The antenna, when erected horizontally, uses four 25-foot masts assembled from the sections provided with Antenna Sys-



4 WAVE LENGTHS PER LEG (SEE TEXT)

FREQ MC	A	B	C	D
70	47.5'	47.5'	60'	26'
82.5	47.5'	43.0'	60'	26'
99.9	47.5'	38.5'	60'	26'

5 WAVE LENGTHS PER LEG (SEE TEXT)

70	59'	53'	70'	29'
82.5	59'	48'	70'	29'
99.9	59'	44'	70'	29'

TM 2601-55

Figure 65. Horizontal rhombic, assembly and ground plan.

tem AS–19(*)/TRC–1; these masts are placed at each of the four corners of the rhombic. Each leg of the rhombic may be either 4 or 5 wavelengths long, as indicated by the table in figure 65.

71. Construction of Horizontal Rhombic

a. Use tables VI and VII for selection of materials and as a reference list during construction of one complete horizontal rhombic.

b. Select the items listed in table VI and place them in a cleared area large enough to permit a diamond-shaped wire pattern, 60 feet on each side, to be stretched parallel to the ground during its construction.

Table VI. Materials Needed for Construction of One Rhombic Antenna

Item	Quantity	Sig C Stock No.
Antenna wire, No. 12 AWG, solid, copperweld.	2 rolls, 125 ft ea.	1A812.7
Insulator IN–86	10	3G586
Rope RP–3	125 ft	6Z7925
Thimble for ¼-inch rope	1	2A3404
Twine RP–13	½-lb roll	6Z8813
Guy GY–24–A or MX–555/U	4	2A1324
Bonding braid 11/16-inch wide	5 ft	1F6C1–11
Terminating resistor, 600-ohms, 118 watt.	1	3Z6060–77
Cord CD–800 or CG–107/U, 50-ft.	2	1F432–800
Shackle	1	5B15520
Shackle bolt and nut	1	6L605–3H
Solder, rosin core		
Tape TL–94	2 rolls	6N8692
Tape TL–83	1 roll	6N8583
Spreaders (par. 78d)	2	
Lacquer		

c. The ground area to be covered during soldering is quite large. In most installations, this will necessitate the use of a portable power unit, such as Power Unit PE–75–(*), to provide current for the 300-watt iron. In order to save both time and gasoline, all the soldering can be done in one continuous operation after assembly of the antenna. Soldering is described in paragraph 77 of this manual and in TB SIG 222.

72. Preparation of Antenna Wires

a. Study the dimensions given in figure 65 and decide on the proper leg length for the antenna. The horizontal rhombic should be 5 wavelengths long if space limitations will permit.

b. Measure two pieces of antenna wire twice as long as dimension A (fig. 65), and add 2 feet to each piece for splicing purposes before cutting. During this and subsequent operations, avoid kinking, scratching, or otherwise harming the wire; wire of this type breaks easily if damaged.

c. Stretch the two wires side by side between two trees or ground stakes, and fasten them temporarily.

d. Cut off four additional 12-inch tie wires from the stock roll and put the roll away.

73. Assembly of Antenna Wires

a. Splice one Insulator IN–86 on one end of each of the two wires just cut, as shown under the metal braid (item No. 9 at junctions of items Nos. 1 and 3, and items Nos. 2 and 3 in fig. 66) with at least 10 wraps of wire. Do not solder yet.

b. Cut a 6-foot piece of rope from the 125-foot piece of Rope RP–3, and tie the ends to the outside ends of the insulators just spliced (junctions of items Nos. 3 and 5, fig. 66).

c. Insert the thimble (item No. 6, fig. 66), and serve with six or eight turns of Twine RP–13 about one-fourth inch above the thimble and tie an overhand knot (item No. 7, fig. 66).

d. Unroll one guy (item No. 4, fig. 66) and snap the hook on the end of the rope through the thimble (item No. 6). Tie the other end of this rope to a tree or other anchor, near the center of one end of the assembly area chosen, with a couple of half hitches. Take care not to lose the hook, ring, and pulley assembly on the rope.

e. Measure one of the wires from the insulator to its exact length (twice dimension A, fig. 65), pulling the wire tight to remove any possibility of error, and then splice another insulator on the free end (items Nos. 1 and 3, fig. 67).

f. Cut a 3-foot piece of Rope RP–3 from the coil and tie it to the free ring of the insulator just spliced (junction items Nos. 21 and 3, fig. 67). Tie the free end of the rope to a tree temporarily to keep the wire from kinking.

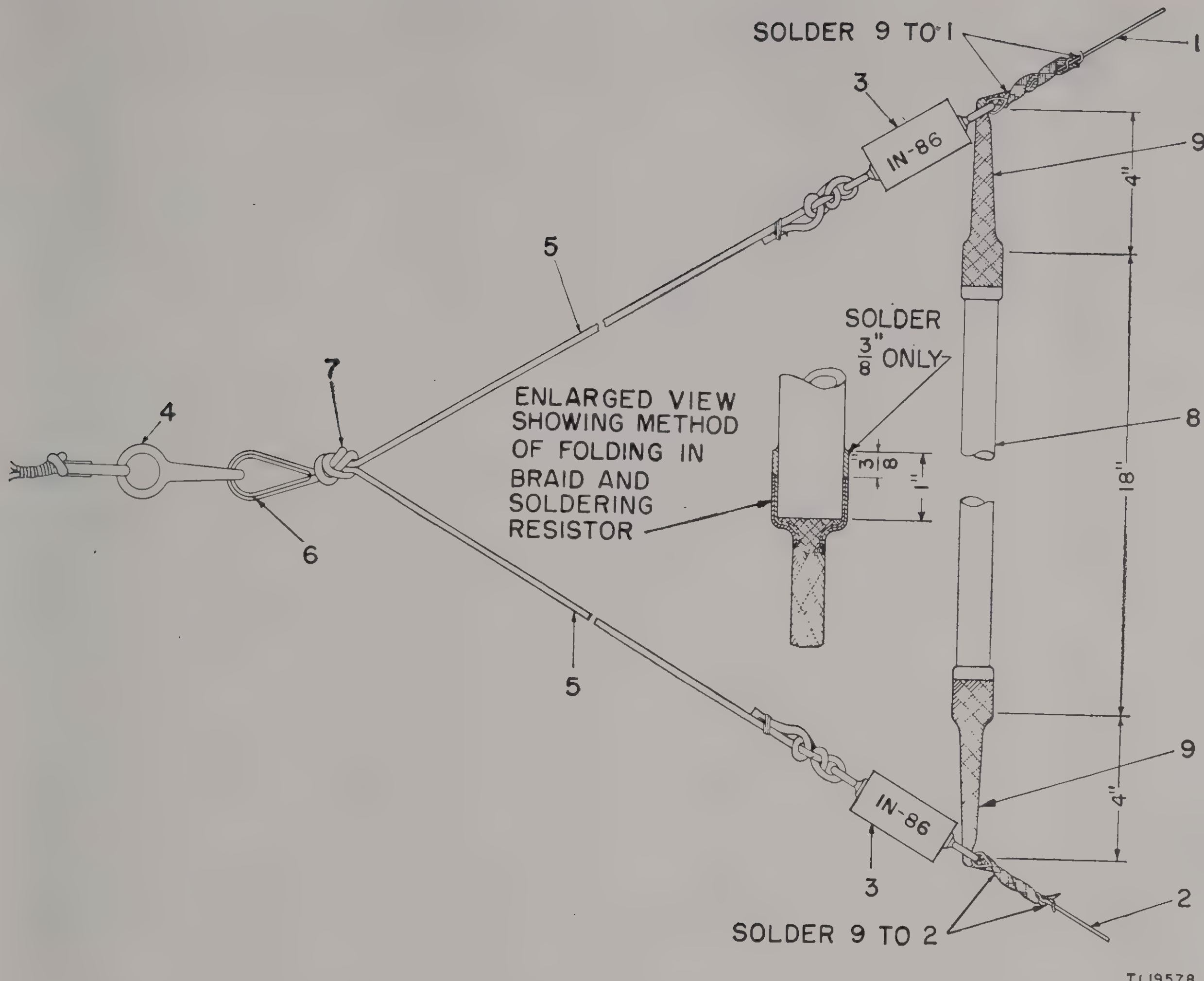


Figure 66. Details of terminating resistor assembly.

g. Measure the second wire in the same way, and splice another insulator to its free end (junction items Nos. 2 and 3, fig. 67).

h. Remove the rope (item No. 21) from the tree and tie its free end to the free ring of this insulator (junction items Nos. 21 and 2, fig. 67), making sure that the distance between the two wires at this point is exactly 26 inches after the rope has been stretched as much as possible. This assembly should now look like the one shown in figure 67 (junction items Nos. 1, 3, 21, 3, and 2 but without items Nos. 22 and 23). By grasping the center of the rope yoke (item No. 21) and stretching the wires, both wires should hang with the same sag. If they do not, resplice one end of one wire until they are exactly equal. Cut off all excess wires at the splices.

i. Attach another guy snap hook temporarily to the center of the rope yoke (item No. 21, fig. 67), and stretch the antenna between two trees or ground stakes so that it cannot kink during the subsequent operations. Serve ropes as shown in figures 66 and 67. *Again be careful not to lose the hardware on the guy.*

j. Attach two Insulators IN–86 to the exact center of each antenna wire with the tie wires previously cut. Put at least eight tight turns in each splice (junction items Nos. 3 and 1, and 3 and 2, fig. 65). *Do not solder yet.*

k. Cut off 60 feet of the central spacing rope (item No. 12, fig. 65). Tie one end to its Insulator IN–86 (junction items Nos. 1, 3, and 12, fig. 65). Serve the knot with Twine RP–13. Then tie the other end of the rope loosely to its Insulator IN–86 (junction items Nos. 12, 3, and

2, fig. 65). Since the central spacing rope determines the width of the antenna, this knot will be untied later for adjustment purposes. The antenna proper is now complete.

74. Terminating Resistor

The terminating resistor assemblies (fig. 66), one for use and two spares, are made as follows:

a. Prepare a 300-watt soldering iron for use.

b. Cut the 5-foot piece of bonding braid into six approximately equal pieces. Each should be at least 9 inches long.

c. Turn one end of each piece of braid inward on itself 1¼ inches.

d. Slip one of the braid sleeves, thus formed, on each end of each of the three terminating resistors, a distance of 1 inch. The tinned ferrules should now be covered with braid.

Caution: Carbon resistors break easily. Do not drop them.

e. Form the braid around the ferrules by hand until it fits snugly and evenly.

f. With the hot soldering iron, flow solder into and through the braid to the ferrule for three-eighths inch from the inside edge of the braid (items Nos. 8 and 9, fig. 66). The solder-free, double-thick braid resting on the edge of the resistor tends to prevent excessive cutting and wearing of the supporting braid during periods of high wind.

g. Carefully put away two terminating resistor assemblies in the spare parts chest, and keep one ready for use.

75. Transmission Lines

The transmission line coupling system causes the unbalanced-to-ground 50-ohm impedance of the feed cable, Cord CD–800 or CG–107/U, to become balanced with its impedance quadrupled to approximately 200 ohms by means of a half-wave matching section (item No. 25, figs. 64 and 67) of Cord CD–800 or CG–107/U. This unit is connected to two transmission line cables (items Nos. 22 and 23, fig. 67) at a point where the line impedance is approximately 200 ohms so that a satisfactory match results. The transmission line tapers outward to a point where its impedance closely matches the input impedance of the antenna, and there it is connected to the radiating wires. The outside braid of the transmission line cables (items Nos. 22 and 23, fig. 67) is used instead of smaller wire to obtain the impedance values required. The apparent short circuit between the shielding and center wires of these cables is intentional.

a. Feed Cable. Provide a sharp knife, a pair of pipe pliers, and Cord CD–800 or CG–107/U which is to be cut, to form this unit. Prepare the feed cable (item No. 26, fig. 68) as follows:

(1) Cut a 24-inch length of Cord CD–800 or CG–107/U (50- or 65-foot) from one end of the cable, leaving the connector on.

(2) Mark the outer covering with a knife at a point 11 inches in from the free end of the 24-inch piece. Continue around the cable with the knife, being careful not to cut into or mark the braid beneath. Then slit this 11-inch piece of outer-covering lengthwise and remove it.

(3) Carefully cut through the braid 10 inches in from the end. Be careful not to harm the dielectric beneath the braid.

(4) Remove the 10-inch piece of braid. Make sure no sharp ends of braid wire penetrate the dielectric. Save this 10-inch piece of braid.

(5) Carefully mark the dielectric 9 inches in from the end by pressing the knife blade directly in to a depth of about one-sixteenth inch, around the cable. Be careful not to nick the center conductor as it will break later if scratched.

(6) Repeat this marking of the dielectric at intervals of 1½ inches out to the end, without touching the center wire with the knife blade. The dielectric can now be broken at each mark by bending it gently back and forth.

(7) Remove each 1½-inch section in turn by pulling it with the pipe pliers while twisting in the same direction that the wire was twisted during manufacture. Do not allow the remaining dielectric to become wet or soiled.

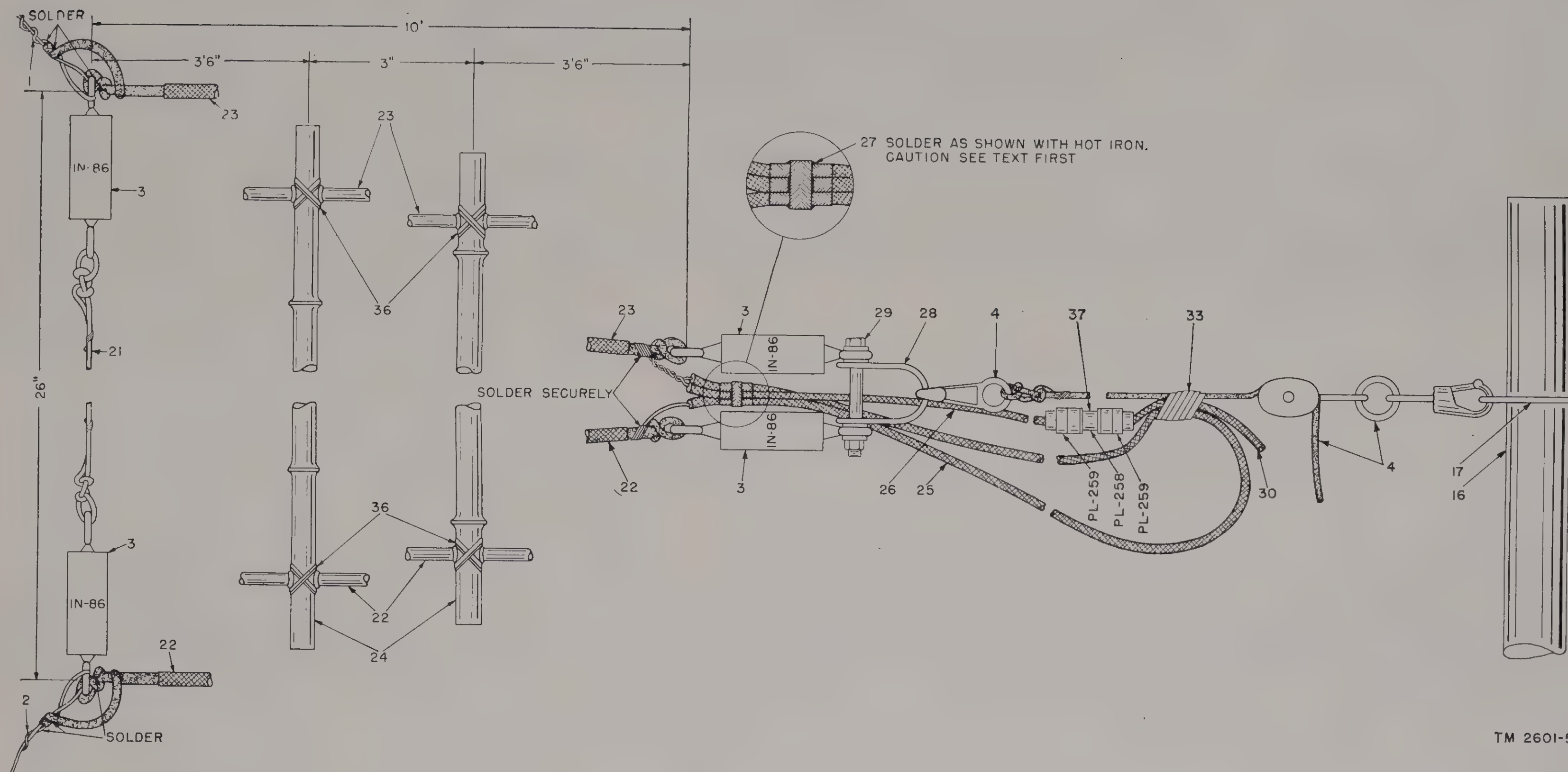


Figure 67. Transmission line coupling system.

b. MATCHING SYSTEM.

(1) Prepare the matching system (item No. 25, fig. 68) in the same manner as the feed cable (*a* above). Any calculations regarding this unit should include the velocity constant of the cable used; in this case, it is .66.

(2) Assemble items Nos. 25 and 26, (fig. 67) by bending item No. 25 double on itself and holding item No. 26 snugly alongside it with friction tape.

(3) Take one of the 10-inch braid ends which came from item No. 25 or 26 (*a*(4) and *b*(1) above), and stretch and form it into item No. 27 (fig. 67), a single-layer braid connecting strap.

(4) Solder it with a hot, sharp-pointed iron by flowing the solder lightly from the strap just formed to the exposed cable braid in at least two places on each of the three cables (insert, fig. 67), being careful to let each spot cool before heating the next. *The dielectric must not be allowed to lose its roundness under the braid while soldering. It melts easily. Keep absolutely dry.*

(5) Trim off all braid not needed to form the single turn strap, remove the tape and put the unit aside.

c. TAPERED TRANSMISSION LINE.

(1) Form the transmission line cables (items Nos. 22 and 23, fig. 68) by cutting two pieces, 12 feet long, from what remains of the 50- or 65-foot cord. The rest goes in the spare parts chest for future repairs if needed.

(2) Remove 12 inches of the outer covering from each end of each 12-foot piece, but *do not* cut the braid this time.

(3) Push the braid back in such a way that it telescopes over the cable, exposing the dielectric.

(4) Remove the dielectric in 1½-inch sections, as before, until only ½ inch projects outside the point at which the braid turns back (section A–A, fig. 68).

(5) Cut off the center conductor to a length of 7 inches and pull the braid back down over the 7-inch wire.

(6) Slide one end of one transmission line cable (item No. 23, fig. 67) through the ring on one end of an Insulator IN–86 (item No. 3, fig. 67) until the bulge in the braid shielding, caused by the dielectric inside, is about 2 inches from the ring.

(7) Tie a single overhand knot. Make sure that the wire inside the braid helps form this knot for extra strength.

(8) Twist one or two turns of the projecting braid, end around the cable close to the ring to form a neat splice, and cut off all that is not needed. *Do not solder yet.*

(9) Repeat the above process for the other line cable (item No. 22, fig. 68) using another Insulator IN–86 (junction items Nos. 3 and 22, center, fig. 67).

(10) Remove the pin from the shackle (item No. 28, fig. 67).

(11) Assemble the transmission line with the empty rings of Insulators IN–86 using the bolt, nut, and washers as shown (junction items Nos. 3, 29, and 28, fig. 67). If the recommended shackle is not available, any substitute which will keep the transmission line cables from 1½ inches to 2 inches apart rigidly, may be used (fig. 69).

76. Assembly of Transmission Line Coupling System

a. Obtain another Cord CD–800 or CG–107/U (50- or 65-foot) and, with the matching section just completed, proceed to the end of the stretched antenna (items Nos. 1 and 2, fig. 67).

b. Extend the transmission line assembly on the ground with the shackle away from the end of the antenna.

c. Slide the free end of the matching section (item No. 23, fig. 67) through the ring of Insulator IN–86 (junction items Nos. 1, 3, and 23, fig. 67) until the bulge is 2 inches from the ring. *Tie a knot.* This time, make only one turn around the cable, letting the braid end hang free.

d. Remove the snap hook of the guy from the rope (item No. 21, fig. 67) which is holding the antenna, and attach it to the shackle (items

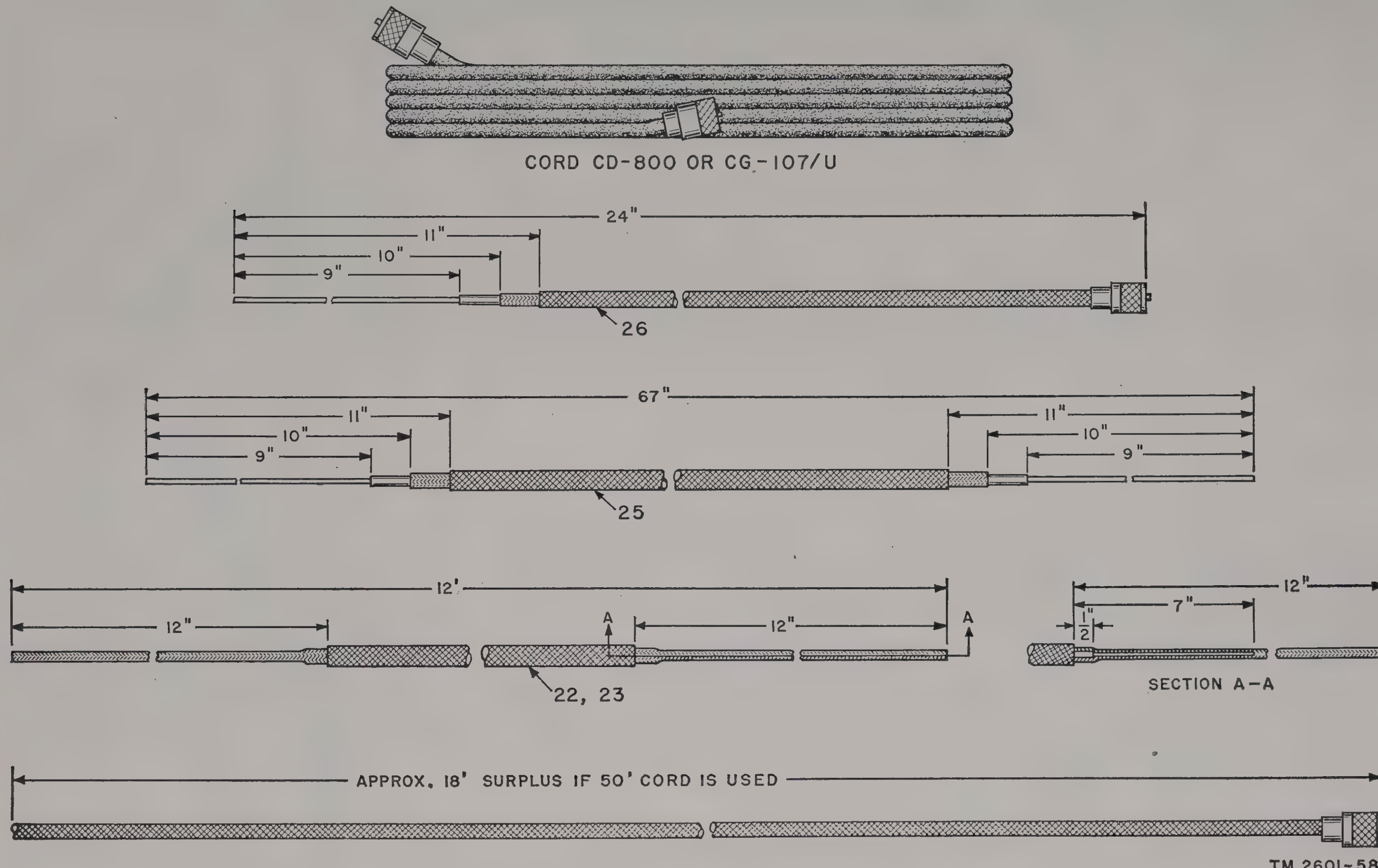


Figure 68. Method of dividing and preparing coaxial cable for construction of coupling system.

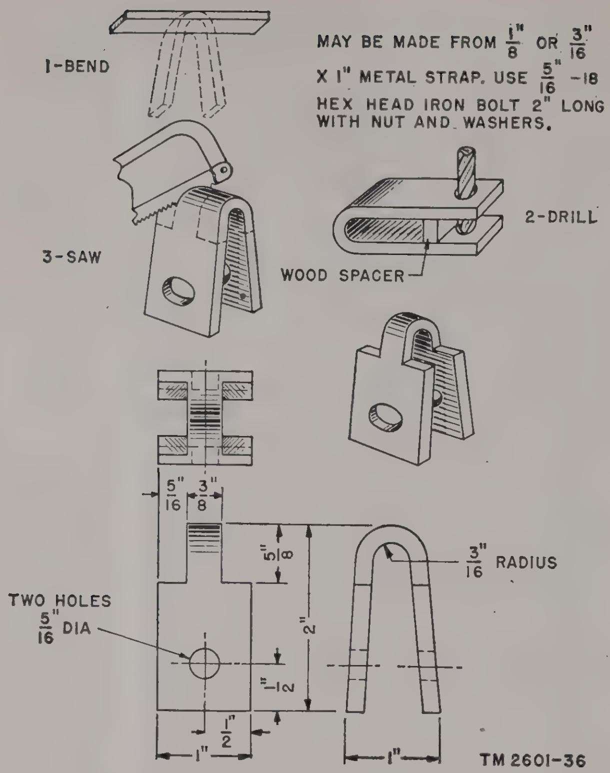


Figure 69. Suggestion for field-improvised clevis (alternate for item 28).

Nos. 4 and 28, fig. 67). Loosely take up the slack in the guy again.

e. Attach the free end of the other transmission line cable (item No. 22) to its Insulator IN–86 with a loose knot (junction items Nos. 2, 3, and 22, fig. 67). Avoid crossing the wire or cables.

f. Adjust the central spacing rope to a length of approximately 45 feet.

g. Spread the antenna by releasing the guy (item No. 4, fig. 65) from the anchor. While one man holds the guy to keep the antenna tight, a second and a third man attach the snap hooks of two Guys GY–24–A or MX–555/U to the empty rings of the outside insulators at the center of the antenna. The second and the third man stretch the antenna out in a diamond shape, about waist-high and parallel to the ground.

h. When the antenna hangs evenly, when the shackle lines up with the thimble, and when the pairs of insulators at each side are opposite each other, the three men may tie their respective ropes to trees, stakes, or other anchors, keeping the antenna tight during the process. The hardware that comes with the guys should be saved.

i. Adjust the loosely tied transmission line cable (junction items Nos. 2, 3, and 22, fig. 67) for length, until it is exactly equal to the other cable (item No. 23), and this time, tie the knot firmly.

j. Make one twist around the cable with the braid end, and for the moment, let the remaining end hang.

k. Twist the stripped 9-inch center wire of the feed cable (item No. 26) with the center wire of one side of the matching section (item No. 25) until a 7-inch pigtail is formed. Wrap this pigtail around the transmission line cable (item No. 23) exactly as shown in figure 67, center.

l. Wrap the exposed 9 inches of the center wire of the other side of the matching section (item No. 25) around the other transmission line cable (item No. 22, center, fig. 67), at the same time separating the exposed dielectric as shown.

m. Check the coupling system circuit just completed against the wiring diagram (fig. 64). If all is correct, the unit is ready for soldering.

77. Soldering

a. Obtain a long extension cord for the 300-watt soldering iron. Start Power Unit PE–75–(*) and plug the iron into the power source.

b. When the iron is hot, flow solder into and through both transmission line matching section feed cable connections (junctions items Nos. 22 and 3, and 23 and 3, fig. 67), but do not let it reach the galvanized insulator rings, as they must turn freely inside the braid.

c. Tin the antenna wire splices (items Nos. 1 and 2, fig. 67). Then twist the braid end of each transmission line cable, previously left hanging (junctions of items Nos. 1 and 23, and 2 and 22, fig. 67), one or two turns around its respective wire splice in such a way that 3-inch loops of braid are formed as shown in figure 67. Trim off the excess braid and solder firmly.

d. Carefully flow solder into the single wrap of braid previously formed around each trans-

mission line cable (junctions items Nos. 2, 3, and 22, and 1, 3, and 23, fig. 67), but do not allow it to flow through to the insulator rings, which again must be free to turn easily.

e. Move the soldering equipment to the center of the antenna, and firmly solder the two splices or tie wire twists at each side of the antenna (junctions items Nos. 3, 1, and 3, and 3, 2, and 3).

f. Move the soldering equipment to the thimble end of the antenna, and get the terminating resistor assembly previously prepared.

g. Tin both antenna wire splices at the insulators (items Nos. 1 and 2, fig. 66).

h. Place the braid from one end of the terminating resistor assembly through the ring of one insulator (solder note, fig. 66). Leave 4 inches of braid between the ring and the resistor, and wrap about 3 inches of braid spirally around the wire joint just tinned. Then bind the end to the antenna wire, with a few turns of small bare copper tie wire. Cut off excess braid.

i. Assemble the braid at the other end of the resistor to the other insulator ring, and wire in the same way.

j. Solder both connections firmly, letting the solder flow through the braid for the distance shown between the arrows (solder note, fig. 66) but being very careful to keep all solder at least 1 inch away from the insulator ring. If solder flows in the braid to a point on the resistor side of the ring, the braid will become stiff and will break in the wind.

78. Taping and Waterproofing

Loosen the knot in the rope yoke (item No. 7, fig. 66) and adjust its position until a pull on the thimble (while keeping both antenna wires taut) will also exert sufficient pull on the braid leads of the terminating resistor to keep it tightly in position.

a. WATERPROOFING TRANSMISSION LINE COUPLING SYSTEM. Cover the transmission line coupling system thoroughly with Tape TL–94 as illustrated (fig. 70), making sure that the tape forms a watertight joint around each insulator and each cable. Use at least one full roll. Fasten the tape end firmly against wind action with Twine RP–13.

b. WATERPROOFING FEED CABLE ASSEMBLY. Attach the feed cable extension consisting of one or more Cords CD–800 or CG–107/U (35-, 50-, or 65-foot) (item No. 30, fig. 67) to the feed cable (item No. 26, fig. 67), or to each other by means of coaxial cable connectors PL–258 (item No. 37, fig. 67). Test the tightness of these connections. Then tape the joint or joints in the usual way with at least two layers of Tape TL–94 (item No. 32, fig. 70).

c. SUPPORTING THE FEED CABLE ASSEMBLY. Tape the matching section and the feed cable assembly to the supporting halyard (junction items Nos. 25, 30, 4, and 33, fig. 67) with a 3-

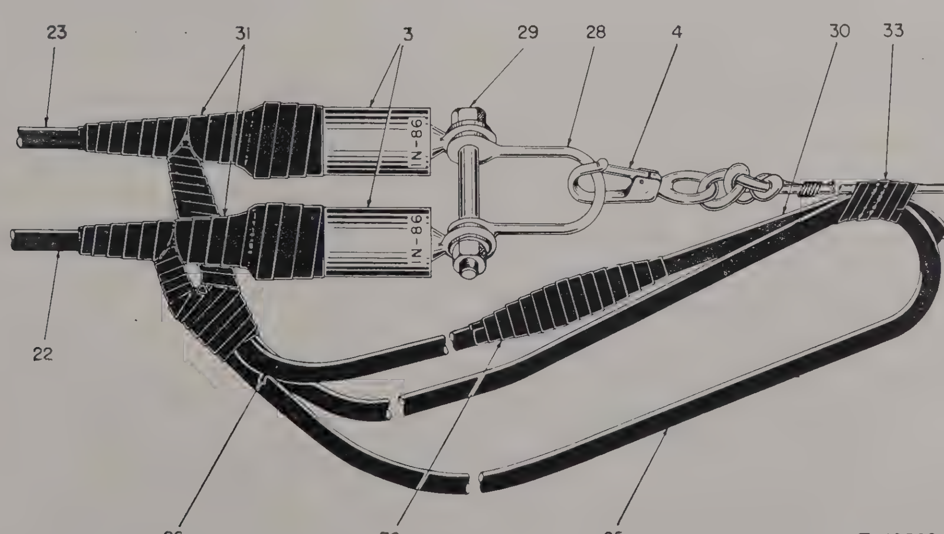


Figure 70. Method of taping coupling unit and cable connectors.

inch double wrapping, and tuck in the ends between the cables to keep the wind from blowing it loose.

d. TRANSMISSION LINE SPREADERS. Cut two spreaders of 5/8-inch or 3/4-inch bakelite tubing, wooden dowel rod, or dry bamboo, to a length that will fit the tapered transmission line (item No. 24, fig. 67) at the positions indicated by the dimension lines. Wrap at least two layers of rubber tape on the outer covering of each transmission line cable where the spreader will rest. Then bind them firmly in place with Twine RP–13 (fig. 67). Keep the projecting spreader ends as short as possible. The transmission line cables must be straight when the job is done.

e. VARNISHING. Apply two coats of a good, outdoor varnish (Lacquer, Fungus-resistant, Sig C Spec No. 71–2202, Signal Corps stock No. 6G1005.3, or equal), to all exposed braid, tape, the terminating resistor, and spreaders, and let dry thoroughly.

79. Preparation for Transport

The antenna is now complete. Prepare it for transport in the following way:

a. Roll up and pack the Guys GY–24–A or MX–555/U which were supporting the sides of the antenna.

b. Detach the halyard (item No. 4, fig. 65) from its anchor, and pull the antenna tight again with it. This should be done while rolling and packing the guys.

c. Lay the terminating resistor assembly on the ground and anchor it with a rock on the rope yoke to keep the wire straight for the time being.

d. Unhook, coil, and pack Guy GY–24–A or MX–555/U.

e. Untie the halyard (item No. 4, fig. 67) from its tree. Carefully place on the ground the transmission line coupling system and the antenna. Anchor them with a rock, and coil up the halyard, which is not detachable from the antenna. Tie the coil of rope in at least three places with twine or string, after making sure its hardware is present.

f. Coil up the feed cable assembly (Cord CD–800 or CG–107/U, item No. 30, fig. 67) into a kinkless coil, about 2 feet in diameter. Tie it with serving twine in four places. Fasten the halyard coil inside it with more twine.

g. Coil the antenna by rolling the cable and rope coil just formed toward the center of the antenna, keeping it always on top of the cable or wire as it rolls. Tie it with short pieces of twine, when necessary. When the center of the antenna has been reached, finish the tying. Then roll the other end of the antenna in toward the center in the opposite direction, tying every few feet as before.

h. When the resulting two coils have been tied together, a bundle results which can be unrolled easily in exactly the opposite order. Any other method of handling this amount of wire, rope, and cable usually results in kinks, tangles, and broken connections.

80. Orientation and Erection

Use materials listed in table VII for erection of one horizontal rhombic antenna.

a. The three wooden mast bases are prepared by sawing a board with an 8-, 10-, or 12-inch width, of any reasonable thickness, into three 18-inch long pieces. Bore 1-inch hole in the center of the broad side of each.

b. Study figure 65 carefully, and then proceed with compass and map to determine the azimuth of the distant station.

Table VII. Materials Needed for Support of Horizontal Rhombic Antenna

Item	Quantity
Wooden mast bases (par. 80*a*)	3
Metal masts 25 feet long	4
Guy plates	4
Guys:	
37 ft long	8
50 ft long	4
Stakes GP–2	8
Stakes GP–25	4

c. Place the metal mast base of Antenna Support AB–33(*)/TRC–1 (item No. 34, fig. 65) at the point where connection is to be made to the radio equipment.

d. Place one wooden mast base 120 feet away from the metal base exactly on a line toward the distant station. The direction line of

the antenna is now established (line C–C, fig. 65).

e. At the midpoint of the line just described, lay out a second line at right angles to the first line (line D–D, fig. 65). Place two more wooden mast bases in position to mark this line as shown (fig. 65), using the dimensions shown in the appropriate table.

f. Lay out four masts, 25 feet long, with their bases placed near the mast bases already laid out (items Nos. 18 and 34, fig. 65). Use 50-foot guys for the outside guy on each of the four masts and 37-foot guys for all others. Use Stakes GP–25 (item No. 35, fig. 65) for the outside guys, where the strain is heavy (item No. 19, fig. 65), and Stakes GP–2 (item No. 14, fig. 65) in all other positions.

g. Attach the snap hooks of the snap-hook ring and pulley assemblies of three Guys GY–24–A or MX–555/U to the guy plates of all masts except the mast which will support the transmission line coupling system. Pull the halyards through their pulleys for 25 feet. Secure both ends of each halyard to the bottom of its mast.

h. Raise the three masts (center and left, figure 65) in the usual way, with a two-section gin pole, if necessary. Pull their guys down tight (30-pound pull) and carefully secure them to the proper stakes. Leave the fourth mast on the ground at right angles to line C–C (fig. 65) with its foot near the metal mast base.

i. Place the antenna on the ground, and then starting at the midpoint of the four mast bases (junction of lines C–C and D–D, fig. 65), unroll the transmission line coupling system toward the metal mast base (right, fig. 65), with the terminating resistor toward the wooden mast base at the opposite corner (items Nos. 18 (left) and 34, fig. 65).

j. Four men should then grasp the corners of the antenna and stretch it out as nearly as possible to the shape it will take when raised. Avoid kinks.

k. Lay the spread antenna on the ground temporarily.

l. Unroll the halyard on the transmission line coupling system (item 4, fig. 67) to its full length, attach the snap-hook ring and pulley assembly on the halyard to the guy plate of the fourth mast (right, fig. 65). Pull 25 feet of the halyard through the pulley and tie the end down to the metal mast base.

m. Raise the fourth mast (right, fig. 65).

n. Hoist the antenna into place on the latter in such a way that the tape wrapping (item No. 33, fig. 67) on the halyard is about 3 feet from the pulley. Make the halyard fast to Stake GP–25 (item No. 35, right, fig. 65).

o. Snap the snap hooks of the other three halyards to their respective corners of the antenna, and take in slack on three halyards until the center of the antenna is approximately 4 feet off the ground.

p. After stretching the central spacing rope to remove all slack, adjust it (item No. 12, fig. 65) to its proper length, as shown in the dimension table.

q. Hoist the center of the antenna with the halyards of the two middle masts until the central spacing rope is tight, adjusting the position of the antenna so that it is centered over the line C–C (fig. 65). A piece of tape on the center of the central spacing rope will help in sighting. Pull the halyards tight and tie them down to their respective outside stakes (items No. 35, center, fig. 65).

r. Hoist the terminating resistor end of the antenna into place with its halyard (item No. 4, left, fig. 65).

s. Readjust the halyards on the two end masts until all four sides of the diamond are tight. The unit is now ready for operation.

t. When two horizontal rhombics are placed side by side as when used at a terminal station, the adjacent corners of the diamonds can be erected within a few feet of each other, since there is little tendency toward interaction between them. Their major axes (line X–X, fig. 65) should be laid out parallel to each other and pointed at the distant station, as indicated by the direction arrows (fig. 65).

81. Adjustment of Horizontal Antenna

a. Man No. 1 manipulates the halyard (item No. 4, left, fig. 65) on the mast at the terminating resistor end of the antenna.

b. Man No. 2 handles the halyard on the left-hand mast (foreground, fig. 65).

c. Man No. 2 adjusts the central spacing rope in 1-foot steps until maximum signal is obtained.

d. Man No. 3 adjusts the halyard on the right-hand mast (top, fig. 65) to keep the antenna properly centered before each reading is taken.

e. Again adjust for optimum signal strength at remote station, or in the case of a receiving antenna, for maximum received signal.

f. The wires of rhombic antennas must be as tight as possible at all times. When the proper dimension B (fig. 65) has been determined for any frequency, record it for future use in case further stretching or shrinking of the central spacing rope occurs. Make new measurements to each new location. Dimension B will usually prove to be less than the figure given in the table, but depends on several unpredictable factors.

82. Characteristics of Vertical Rhombic Antenna

a. POLARIZATION. The rhombic antenna when erected vertically will produce slightly more signal strength than a horizontal rhombic of the same dimensions when operating over sea water, if its average height is less than 50 feet above sea level. However, when this value is exceeded, the advantage becomes negligible. The vertical rhombic antenna is less subject than the horizontal rhombic antenna to variations in signal strength caused by reflections from aircraft flying in or over the transmission path, but more subject to man-made electrical noises which are usually vertically polarized. The vertical rhombic is particularly susceptible to interference caused by radiation of harmonics from nearby transmitters, operating on any frequencies, with vertical whips or other vertically polarized antenna equipment. DO NOT USE A VERTICAL RHOMBIC WHEN ATTEMPTING TO CONTACT A REMOTE STATION WHICH IS USING A HORIZONTALLY POLARIZED ANTENNA SYSTEM.

b. DIMENSIONS. When erected vertically, the antenna utilizes a 45-foot center mast and two 25-foot end masts assembled largely from components of Antenna System AS–19(*)/TRC–1. If sufficient mast sections are available, these heights may be 50 and 30 feet, respectively. The rhombic erected vertically is limited in size by the height of the center mast and, therefore, will always be 4 wavelengths long per leg (dimension A, fig. 71).

83. Construction of Vertical Rhombic

The assembly and construction of a vertical rhombic antenna is the same as for a horizontal rhombic antenna (table VI and pars. 71 through 79).

84. Erection and Orientation of Vertical Rhombic

a. SELECTION OF SITE. Choose a flat piece of ground at least 200 feet long and 100 feet wide for one vertical rhombic. If two rhombics are to be used, as is usually the case at a radio-relay terminal, the space should be 200 feet wide. In this case, place the two units side by side, 80 to 100 feet apart, with the planes of their diamond-shape antenna wires parallel to each other.

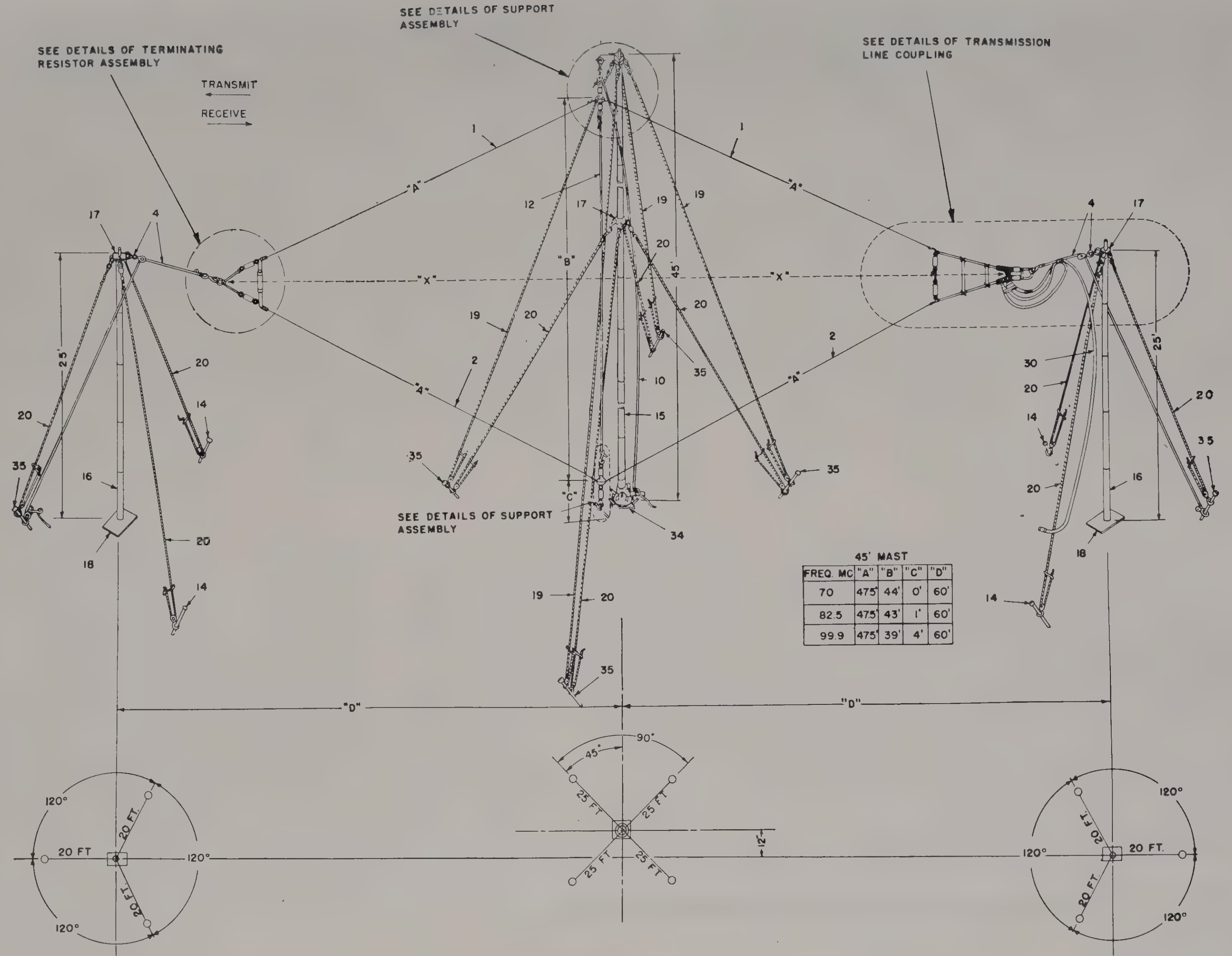
b. POINTING THE ANTENNA.

(1) Find the azimuth of the station to be contacted, using the compass and map. A line from the coupling unit end of the rhombic through the terminating resistor of each antenna (dotted line X–X, fig. 71) must point at the distant station. Each antenna transmits or receives in the direction shown by the arrows in figure 71.

(2) When the proper direction has been determined, move the map and compass to a point 12 or 13 paces in from one side, and 10 paces forward from the rear line of the area chosen (the side away from the distant station). This is the rear mast location. Place one of the fabricated wooden mast bases (item No. 18, right, fig. 71) at that point. Drive a Stake GP–2 through the hole in the mast base about 8 inches into the ground.

(3) Using the compass, place a second wooden mast base (item No. 18, left, fig. 71) 120 feet away from the first, on an exact line toward the station to be worked (ground plan, bottom, fig. 71). Drive a second Stake GP–2 through the hole in this mast base.

(4) Place the metal mast base of Antenna Support AB–33(*)/TRC–1 1 foot to



45' MAST

FREQ. MC	"A"	"B"	"C"	"D"
70	475'	44'	0'	60'
82.5	475'	43'	1'	60'
99.9	475'	39'	4'	60'

Figure 71. Vertical rhombic, assembly and ground plan.

the right of the midpoint of the line formed by the wooden mast bases, as shown in figure 71. Secure it with Stakes GP–2 in the usual way.

c. Preparation and Erection of Center Mast.

(1) Prepare the halyard (item No. 10, fig. 71) for the center mast by firmly tying a 50-foot piece of Rope RP–3, taken from what is left of the 125-foot coil, to the end of a Guy GY–24–A or MX–555/U. Make sure that the snap-hook ring and pulley assembly is in place on the latter.

(2) Lay out the center mast, Antenna Support AB–33(*)/TRC–1, at right angles to the line of mast bases, as described in this technical manual, and add an extra mast section to make the total height 45 feet (fig. 71).

(3) Place the masthead halyard support bracket above the guy plate on the top mast section and tighten the screws. The top guys may be placed either at the top of the top mast section or at the usual place, 7 sections up from the bottom.

(4) Hook the snap-hook of the pulley assembly of the halyard (item No. 10, fig. 71) through the hole provided in the masthead halyard support bracket. Pull the halyard through the pulley for 50 feet and tie its two ends to the bottom of the mast.

(5) Raise the 45-foot mast in the usual way, tightening down all (Nylon) guys with at least a 30-pound pull. *Note the position of the stakes in the ground plan* (fig. 71).

d. Antenna Preparation. Unroll the antenna, parallel to the line of mast bases but 25 feet to the left of all three, so that the antenna will clear the guys going up. Place the terminating resistor assembly end toward the distant station (fig. 71) and the coupling unit, with the rear halyard and feed cable assembly, to the rear.

e. Erection of End Masts.

(1) Lay out one end mast (left, fig. 71), five mast sections long and attach a Guy GY–24–A or MX–555/U to the guy plate (item No. 17, left, fig. 71). Pull 25 feet of the halyard through the pulley. Tie the halyard ends down to the base until needed.

(2) Raise this end mast in the usual way, using a two-section gin pole, if necessary, and setting the opening in the bottom mast section over the stake in the wooden base. Tighten the guys, particularly the back one (item No. 20, on stake, item No. 35). Place the gin pole against the base of the mast when wooden mast bases are used. The back stake of each end mast is the usual Stake GP–25 and the others are Stakes GP–2, since the strain on the back guy is much greater than on the other two.

(3) Lay out the other end mast (item No. 16, right, fig. 71), five sections long, and snap the hook of the pulley assembly of the halyard attached to the antenna (item No. 4, right, fig. 71) to its four-hole guy plate. Pull the halyard through 25 feet and tie it down to the base.

(4) Raise the mast as in subparagraph (2) above.

f. Raising the Antenna.

(1) Attach the snap-hook ring and pulley assemblies of the left and center halyards (items Nos. 4, left, and 10, fig. 71) through the thimble (item No. 6, fig. 66) and the ring of the top insulator (items Nos. 10 and 3, fig. 72).

(2) Hoist the center of the antenna to the top of the center mast, outside the guys, and tie the halyard firmly to the mast base (items Nos. 10 and 34, fig. 71). Keep the wire clear and free of kinks. Protect the terminating resistor during this operation.

(3) Drive a Stake GP–2 in the ground 6 inches away from the center mast base (item No. 34, fig. 71), and tie the bottom insulator assembly of the antenna to it with a 10-foot piece of Rope RP–3 (item No. 13, fig. 72). Allow 3 or 4 feet of rope between the antenna and the ground.

(4) With the halyard of the rear mast

(right, fig. 71), hoist the transmission line coupling system and feed cable assembly a few feet off the ground.

(5) Release the four guys on the antenna side of the center mast from their respective stakes, *one at a time,* pass them over or through the antenna, and refasten them to their stakes so that when completely raised, the wire will clear all ropes.

(6) Hoist the transmission line coupling assembly into position (taped feed cable, halyard junction, 2 feet from right end mast, fig. 71) and tie down the halyard to its stake (item No. 35. right, fig. 71).

(7) Hoist the terminating resistor into place and tie down its halyard (item No. 4) to the stake (item 35, left, fig. 71).

g. Adjustment of Vertical Spacing.

(1) Adjust the central spacing rope (item No. 12, fig. 71) and the anchor rope (item No. 13, fig. 72) in such a way that when both are tight, dimension C (center, fig. 71, and dimension table) is correct for the frequency to be used. Measure C from the wire to the ground.

(2) Readjust all halyards until the antenna is tight in all directions with its long axis (line X–X) parallel to the ground. It will not usually be possible to raise this axis more than 22½ feet from the ground with the center mast shown. If longer masts are available they should be used, keeping dimension B as shown, regardless of C.

h. Steering the Antenna. Since an incoming signal from a remote station may not always arrive at a receiving station on exactly the azimuth of the distant station itself, some degree of steering either the vertical or horizontal antenna may be necessary for optimum results. Shifting the light end masts in opposite directions from each other around the center of the antenna as a pivot (a few feet in either direction) should soon show the operator of the receiver whether or not his antenna is properly oriented.

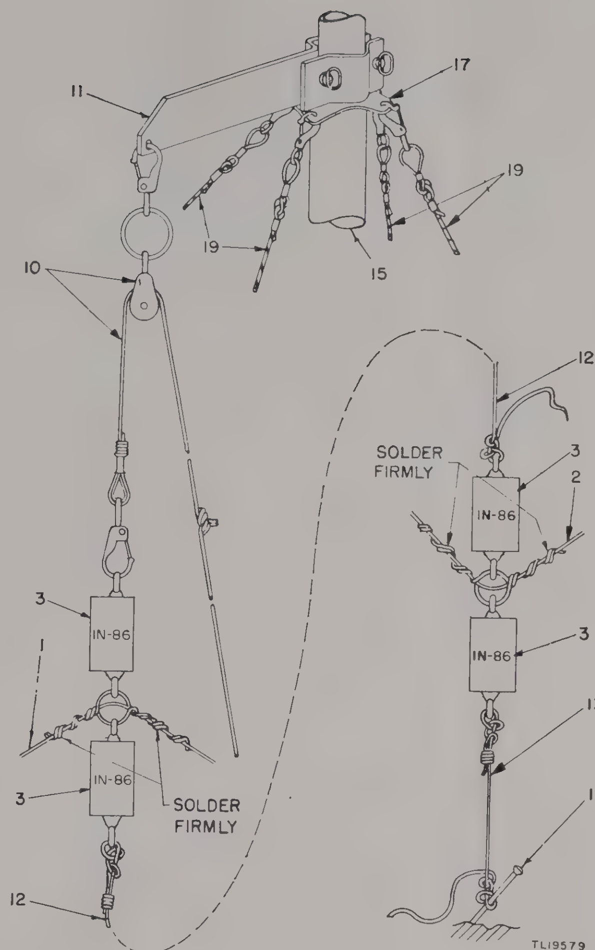


Figure 72. Method of supporting and anchoring vertical rhombic.

i. General. Use a wooden mast in place of the metal one at the termination end of the vertical rhombic if one is available or can be fabricated easily. Never use unbroken metal guys, such as the stainless steel guys furnished with Antenna System AS–19C/TRC–1, with vertical rhombic antennas.

85. Adjustment of Vertical Rhombic

Use the following procedure to adjust the vertical rhombic, since ropes stretch and dimension B (fig. 71) is important when weak signals are being received.

a. Have one man (No. 1) manipulate the halyard of the mast at the terminating resistor and of the antenna (left, fig. 71) while a second man (No. 2) stations himself at the center mast.

b. Man No. 1 slacks off his rope 2 or 3 feet, slackening the antenna in turn.

c. Man No. 2 releases the anchor rope (item No. 13, fig. 72) and shortens or lengthens the central spacing rope (item No. 12, figs. 71 and 72) 1 foot, and then reties the knot to the insulator.

d. Man No. 1 pulls his halyard tight again.

e. Man No. 2 takes the slack out of the lower wire (item No. 2, fig. 72) with the anchor rope.

f. When No. 2 has stepped away from the wire, another reading is taken.

g. Repeat this process, shortening and/or lengthening the central spacing rope in steps of 1 foot for at least 3 feet either side of the starting position (dimension C, fig. 71). If the antenna is tight when readings are taken and time has been allowed to observe the average reading each time, the central spacing rope should be finally adjusted to the point where the highest reading is obtained. Readjust the ANTENNA TUNING for maximum signal each time.

h. Keep halyards and anchor rope adjusted to keep axis X–X parallel to the ground.

86. Emergency Antennas

a. There are two types of easily constructed long-wire antennas for use in instances when normal antenna equipment has been damaged by local or enemy agencies. Both the horizontal V and the inverted V beam antennas (pars. 87 and 88) are suitable for emergency use.

b. The most easily improvised antenna is a center-fed half-wave. This may be made by using the two center dipoles of antenna AS–20(*)/TRC–1, if they are available. Figure 73 gives instructions for constructing an emergency half-wave antenna.

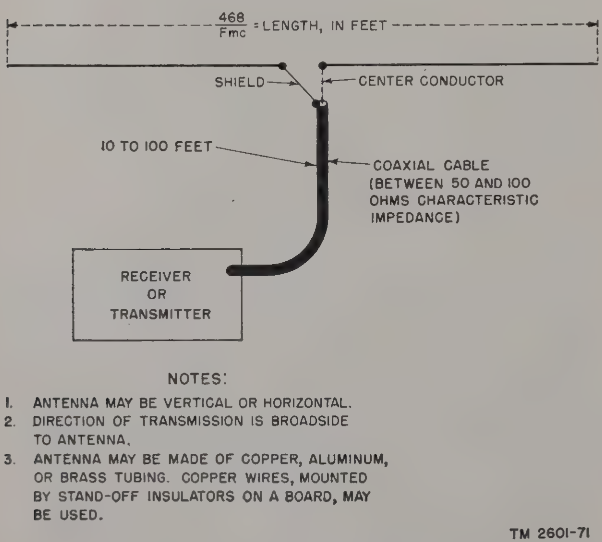


Figure 73. Construction of an emergency half-wave antenna.

87. Horizontal Half Rhombic Antenna

The horizontal half rhombic, or V beam, antenna requires three poles instead of four. However, since the average height of this antenna is the height of the masts used, a horizontal half rhombic, 100 feet long per side and raised 40 feet from the ground, will give better performance than a 40-foot high Antenna AS–20(*)/TRC–1 at the same location. The half rhombic has a gain of about 9 db over a dipole and 3 db over Antenna AS–20(*)/TRC–1. In addition, since this V antenna transmits horizontally polarized waves, it will function satisfactorily when transmitting to or receiving from a distant station using horizontal polarized Antenna AS–20(*)/TRC–1. This, therefore, is the best emergency antenna.

88. Vertical Half Rhombic Antenna

The vertical half rhombic, or inverted V, antenna is comparatively poor when operated at frequencies between 70 and 100 mc. A typical inverted V antenna constructed with as much as 7 wavelengths of wire (100 feet) in each side, requiring a mast height of 34 feet, has the very low average height of 12 feet. Consequently, on low or tree-covered terrain, Antenna AS–20(*)/TRC–1, 40 feet high, will produce greater signal strength at a distant point. Again, since the V is vertically polarized it will operate only with another vertical antenna system. However, in an emergency, an inverted V antenna (even fabricated from Wire W–110–B) will permit a degree of communication provided vertical polarization is used at both ends of a circuit simultaneously. With this type of antenna high cleared ground is essential for good results.

89. Selection of Rhombic Antenna Sites

a. The effect of trees, surrounding buildings, terrain irregularities, and other natural and man-made obstacles is more pronounced on the rhombic antenna than on the dipole array. Thus, the 6-db gain of Antenna AS–20(*)/TRC–1

over a dipole at the same height may easily provide more signal strength at a distant receiver than the 12-db gain of the rhombic, if the 40-foot mast of the former allows it to see out over surrounding vegetation while a rhombic, installed lower than 40 feet, wastes its energy in nearby foliage or other obstacles. An increase in antenna height from 20 to 40 feet is important when operating on low clear terrain, since it will increase the operating distance between two stations by almost one-third. When on hills 350 feet high or higher, such a small height increase helps little since it is so small compared to the total height of mast plus hill.

b. Place all v-h-f antennas as near as possible to the edges of plateaus or hill-tops on the side nearest the distant station, since the height above the intervening terrain is the important consideration. A signal from or to a v-h-f antenna may be reduced as much as 10 db by moving the antenna back 1,000 feet from the edge of a hill.

c. Erect all rhombic antennas over flat, level terrain with the horizontal axis of the vertical or both axes of the horizontal parallel to the earth, and with their longer axes always pointed at the distant station. See the transmit and receive arrows in figures 65 and 71. If the ground itself slopes gently toward the distant station, as much as 7° below the horizontal, a slight gain in signal strength will be obtained.

90. Terminal Station Installation of Rhombics

a. Horizontal Rhombic Antennas. If two antennas are required at one location, which is usually the case with Radio Terminal Set AN/TRC–3(*), they should be placed side by side with their longer axes parallel to each other. The spacing between adjacent side corners need not exceed 10 feet. However, the greater the distance the better, provided the usual feed cable length is not exceeded.

b. Vertical Rhombic Antennas. When both antennas of Radio Terminal Set AN/TRC–3(*) are to be vertical rhombics, the second unit should be placed 80 to 100 feet away from and parallel to the first antenna.

91. Relay Station Installation of Rhombics

a. Horizontal Rhombic Antennas. If four antennas are to be used with Radio Relay Set AN/TRC–4(*), they should be placed at the four corners of a square with transmitting antennas on one side pointing in opposite directions and receiving antennas on the other side. As in the erection of horizontal rhombics at terminal station installations, horizontal spacing is not critical.

b. Vertical Rhombic Antennas. If the occasion arises where four rhombics are required with Radio Relay Set AN/TRC–4(*), a considerable area (240 feet by 360 feet, minimum) is required. Place the antennas at the four corners of a square with each pair pointing toward its respective distant station. Arrange the transmitting antennas on the same side of the area, coupling end to coupling end, with the receiving antennas on the opposite side arranged in the same way. Back-to-back operation of this type reduces possible interaction.

92. Receiving with Rhombic Antennas

a. Connect Cord CD–800 or CG–107/U (50- or 65-foot) of the feed cable assembly, to the ANT. INPUT connection of the receiver with the shortest length of cable possible.

b. Adjust the ANTENNA TUNING control of the receiver for maximum signal. (It is assumed that the remote station is transmitting with an antenna which has the same polarization characteristics as the rhombic under discussion.)

c. Observe the signal level indicated on the meter with the meter switch in the proper position to register 1ST LIM. GRID current (position 1 or 2).

d. Adjust dimension B (figs. 65 and 71) in 1-foot steps until maximum signal is received.

93. Transmitting with Rhombic Antennas

a. Connect the feed cable to the ANTENNA connection of the transmitter or amplifier.

b. Tune the antenna circuit in the usual way. If the proper loading does not result, slightly increase the coupling in the output circuit until normal meter readings are obtained.

c. Adjust dimension B of the transmitting antenna, either vertical or horizontal, while the station at the remote end of the circuit reports average signal strength (observed for at least

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30 seconds if fading is present) when requested. Make sure that both receiving antennas (in relay applications) have been adjusted for optimum signal first. Retune transmitter antenna circuits after each antenna adjustment before readings are taken by the remote station.

d. When all rhombics to be used in any single radio-relay jump have been properly adjusted, each station should in turn shut off its transmitting equipment to allow the station at the other end of the circuit to observe whether or not interference from its own transmitter is being received. If such interference is too strong to allow proper operation, the antennas at that point will have to be spaced farther apart or another frequency will have to be chosen. A change in frequency should never be made at any station until the remote station has been notified and permission has been obtained from the proper authorities.

94. Location of Power Units

a. Much noise can be introduced into any receiving antenna by the ignition systems of nearby gasoline engines. Power Units PE–75–(*), or other similar power sources operating with radio-relay equipment, should always be placed as far as possible from *all* antennas. If a choice has to be made, make the distance to the receiving antenna the greater of the two. The same rule holds for stations using four antennas. A point at the center of the square formed by the four masts supporting the transmission line coupling systems of the four rhombic antennas will ordinarily prove satisfactory.

b. Never place rhombic antennas in such positions that any of their side wires are close to and paralleled to power lines. Keep other types of transmitting stations as far as possible from the v-h-f antennas at all times.

Section IV. INSTALLATION OF RADIO SET AN/TRC–1(*) OR RADIO TERMINAL SET AN/TRC–3(*)

95. Location of Radio Set

Although these sets are furnished in weatherproof cases, the equipment should be housed in a suitable shelter. This added protection is especially important when transmitters and receivers are to be alined or serviced. Locate the receiver and transmitter as close as possible to their respective antennas so that a 50- or 65-foot Cord CD–800 or CG–107/U will be adequate.

96. Location of Power Supply Unit

Place the power units as far from the radio station as the junction box and extension cording will permit and away from and behind the receiving antennas. Power units may be operated in the open, but they should be placed on high ground or on a suitable platform.

Warning: If the power units are operated within a building, make certain that all exhaust connections are tight and that the exhaust tube extends outside the building. Exhaust gases contain carbon monoxide, a DEADLY POISON which is tasteless and odorless.

97. Uncrating, Unpacking, and Checking

For domestic shipment, all pieces of equipment are transportable in their own cases and no special unpacking instructions are required (par. 61). All components should be checked and the tubes must be firmly seated in their sockets.

98. Installation of Transmitter and Receiver

a. Open the front covers of Case CY–18(*)/TRC–1 and Case CY–17(*)/TRC–1. If the equipment is to be used in inclement weather, pull the canvas protective hoods over the front panels.

b. Check to see that all tubes are in their proper sockets. Remove dust from the blower screen.

c. Plug the a-c cords of the receiver and transmitter into the sockets on Junction Box JB–110.

d. Connect the receiver and transmitter as shown by the cording diagrams (figs. 74 through 78) depending on the type of operation required.

e. Ground all transmitters by connecting

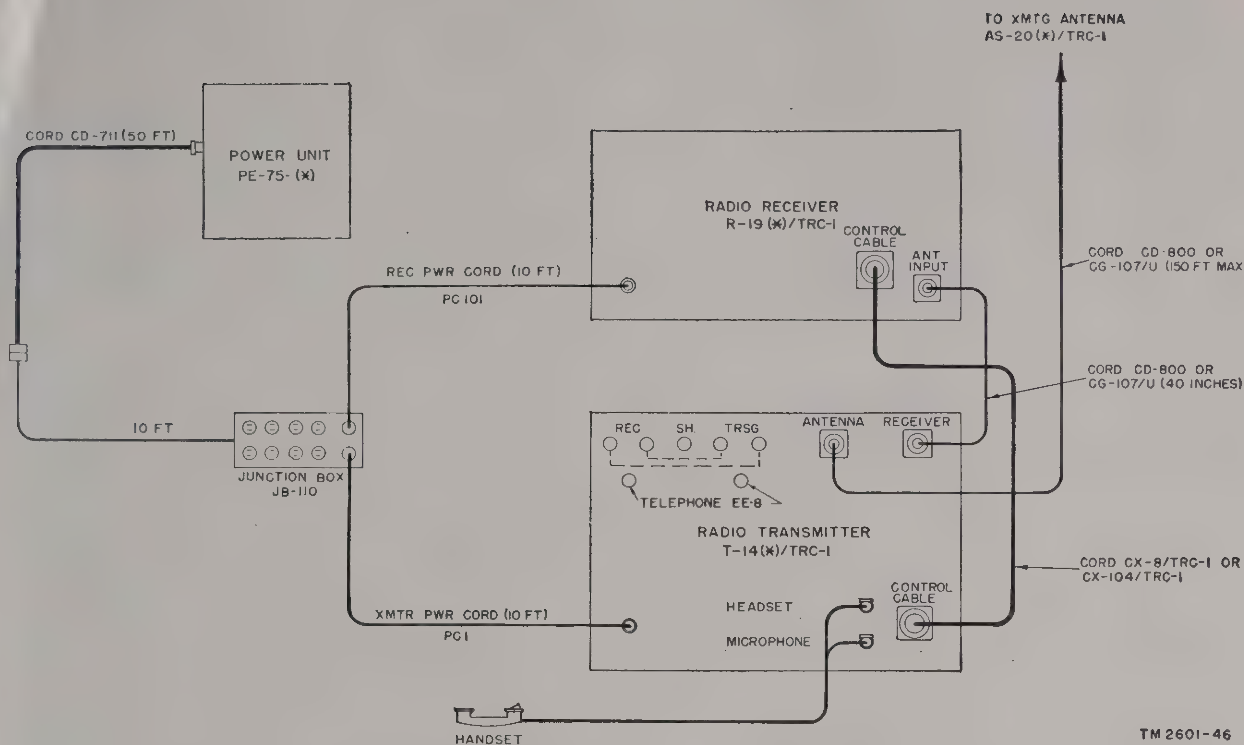

Figure 74. Cording diagram of Radio Set AN/TRC–1(*) for single-channel simplex terminal station.

the binding post marked SH. to a rod driven into moist earth. The lightning arrestors (fig. 32) may be removed at relay stations.

99. Connections for Single-Channel Simplex Terminal Station
(fig. 74)

a. Cord CD–711 is a 50-foot, two-conductor, rubber-covered extension cord with a twist lock plug at one end and a socket at the other (par. 30*d*). It connects the power unit to the cord from Junction Box JB–110. If Radio Terminal Set AN/TRC–3(*) is used, Junction Box J–85/G (not included with Radio Set AN/TRC–1(*)) may be used between the power units and Cord CD–711 (fig. 76).

b. Receiver power cord PC101 is a 10-foot cord leading from the A-C LINE of Radio Receiver R–19(*)/TRC–1; it plugs into Junction Box JB–110.

c. Transmitter power cord PC1 is a 10-foot cord leading from the A-C LINE of Radio Transmitter T–14(*)/TRC–1; it plugs into Junction Box JB–110.

d. Cord CX–104/TRC–1 is a shielded, seven-conductor, rubber- or plastic-covered cable used to interconnect Radio Transmitter T–14(*)/TRC–1 with Radio Receiver R–19(*)/TRC–1 (par. 30*b*). Cord CX–8/TRC–1 is used with the unlettered models of the receiver and transmitter in place of Cord CX–104/TRC–1.

e. Cord CD–800 or CG–107/U (40-inch) is used as an operating component for interconnecting the antenna circuits of Radio Receiver R–19(*)/TRC–1, Radio Transmitter T–14(*)/TRC–1, and Amplifier AM–8(*)/TRA–1. It connects between the RECEIVER receptacle on the transmitter front panel and the ANT. INPUT receptacle on the receiver front panel. When Amplifier AM–8(*)/TRA–1 is used, two of these cords may be needed. One connects the ANTENNA receptacle on the transmitter to the R-F INPUT receptacle on the amplifier. The other, required when only one antenna is used, connects the RECEIVER receptacle on the amplifier to the ANT. INPUT on the receiver.

f. Cord CD–800 or CG–107/U (35-, 50-, or 65-foot) is fitted at each end with Plug PL–259–(*) and is used for connecting the antenna to the receiver, transmitter, or amplifier. One plug is inserted into the antenna receptacle on

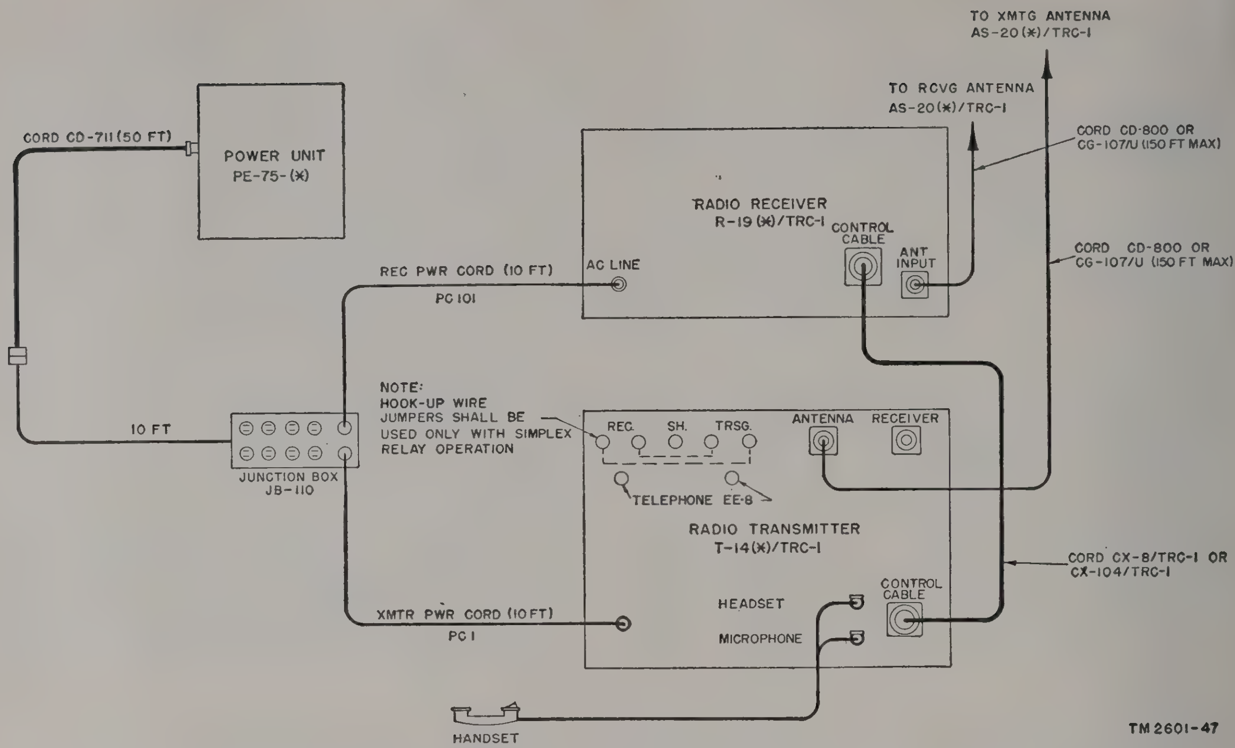

Figure 75. Cording diagram of Radio Set AN/TRC–1(*) for single-channel duplex terminal station or single-channel simplex relay station.

the transmitter, receiver or amplifier front panel and the other into Antenna AS–20(*)/TRC–1.

100. Connections for Single-Channel Duplex Terminal Station

Single-channel duplex operation requires two antennas. Connections and interconnections (fig. 75) are the same as used for single-channel simplex operation except Cord CD–800 or CG–107/U (40-inch), used for connecting the antenna circuits of the transmitter and receiver, is eliminated. Cord CD–800 or CG–107/U (35-, 50-, or 65-foot) is plugged into the ANT. INPUT of Radio Receiver R–19(*)/TRC–1 and connected to receiver Antenna AS–20(*)/TRC–1.

101. Connections for Multichannel Duplex Terminal Station

a. Cord CD–711 (50-foot) is used to connect Junction Box J–85/G, at the power units, to Junction Box JB–110, at the radio station (fig. 76).

b. The receiver power cords leading from the A-C LINE of Radio Receiver R–19(*)/TRC–1 and Radio Transmitter T–14(*)/TRC–1 plug into Junction Box JB–110.

c. Cord CX–104/TRC–1 (Cord CX–8/TRC–1 with unlettered models) is used to interconnect Radio Receiver R–19(*)/TRC–1 and Radio Transmitter T–14(*)/TRC–1. The cord is plugged into the CONTROL CABLE receptacles of both receiver and transmitter.

d. Cord CD–800 or CG–107/U (35-, 50-, or 65-foot) is used for connecting Receiver R–19(*)/TRC–1 and Radio Transmitter T–14(*)/TRC–1 to Antennas AS–20(*)/TRC–1, respectively. The cords lead from the ANT. INPUT receptacle on the receiver front panel and the ANTENNA receptacle on the transmitter front panel to their respective antenna arrays.

e. Spiral-four cable (par. 31) is used as a connecting link between Telephone Terminal CF–1–(*) and Radio Transmitter T–14(*)/TRC–1. The two wires of the same color, diagonally opposite each other, form a pair in the cable. The carrier system provides one direc-

tion of transmission for four telephone channels over one cable pair, and the opposite direction over the other pair.

(1) The colored pair of wires from the cable stub is connected to the TRSG. binding posts on the front panel of Radio Transmitter T–14(*)/TRC–1.

(2) The white pair of wires from the cable stub is connected to the REC. binding posts on the front panel of Radio Transmitter T–14(*)/TRC–1.

(3) The shield is connected at one end to the SH. binding post on the front panel of Radio Transmitter T–14(*)/TRC–1 and the other end is connected to the SH. binding post located on the top center of the bay of Telephone Terminal CF–1–(*). Connect the SH. binding post to a ground rod.

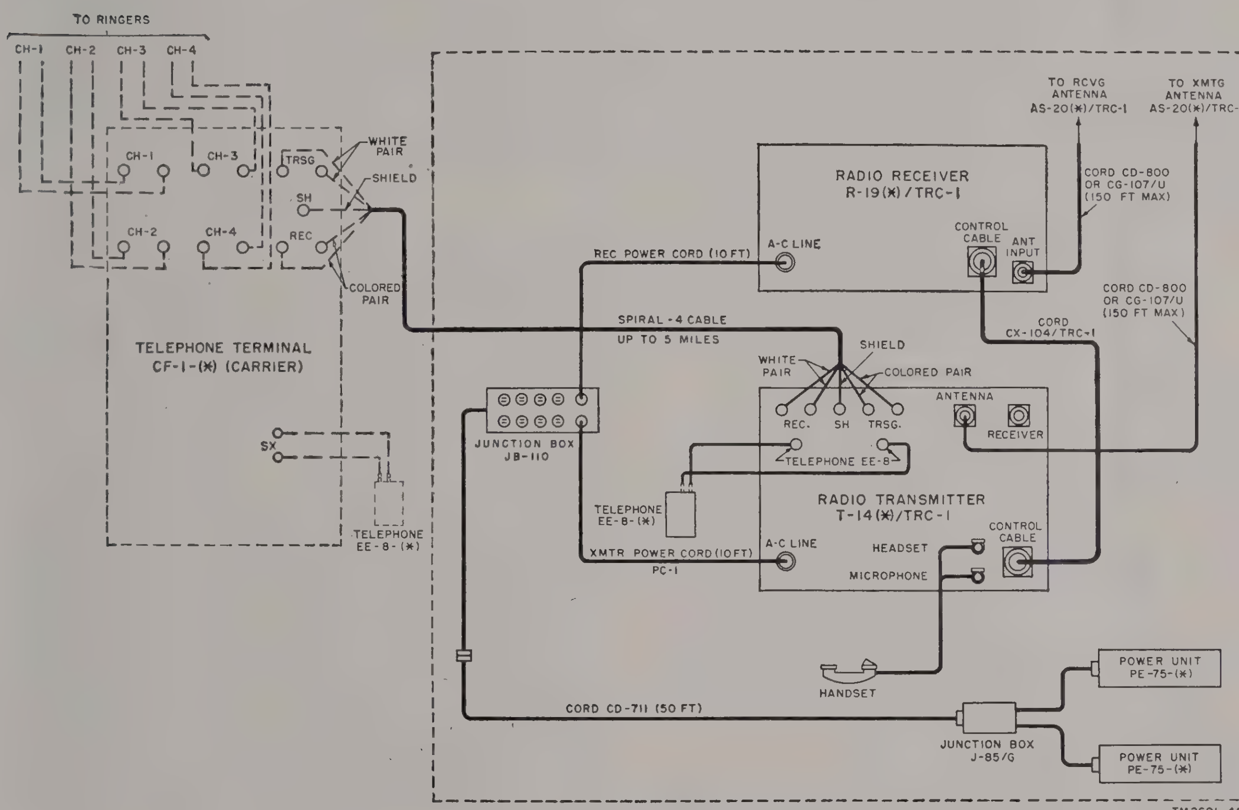

Figure 76. Cording diagram of Radio Terminal Set AN/TRC–3(*) in duplex multichannel system.

102. Cabling Charts

Tables VIII, IX, and X list the cables supplied with the radio sets and the components which the cables connect in the sets applications:

Table VIII. Cording Radio Set AN/TRC–1(*) for Single-Channel Simplex Terminal Station

Cable No.	Cord	No. req.	Length	Connects	
				From	To
1	CX–104/TRC–1 (CX–8/TRC–1 in unlettered models).	1		Transmitter	Receiver.
2	CD–800 or CG–107/U	1	40 in.	Transmitter	Receiver.
3	CD–800 or CG–107/U	Up to 3	35, 50, or 65 ft.	Transmitter	Antenna.
4	PC1	1	10 ft.	Transmitter	Junction Box JB–110.
5	PC101	1	10 ft.	Receiver	Junction Box JB–110.
6	CD–711	1	50 ft.	Power unit	Junction Box JB–110.

Table IX. Cording Radio Set AN/TRC–1(*) for Single-Channel, Duplex Terminal Station or Single-Channel Simplex Relay Station

Cable No.	Cord	No. req.	Length	Connects	
				From	To
1	CX–104/TRC–1 (CX–8/TRC–1 in unlettered models).	1		Transmitter	Receiver.
2	CD–800 or CG–107/U	Up to 3	35, 50, or 65 ft.	Transmitter	Antenna.
3	CD–800 or CG–107/U	Up to 3	35, 50, or 65 ft.	Receiver	Antenna.
4	PC1	1	10 ft.	Transmitter	Junction Box JB–110.
5	PC101	1	10 ft.	Receiver	Junction Box JB–110.
6	CD–711	1	50 ft.	Power unit	Junction Box JB–110.

Table X. Cording Radio Terminal Set AN/TRC–3(*) for Duplex Multichannel System

Cable No.	Cord	No. req.	Length	Connects	
				From	To
1	CX–104/TRC–1 (CX–8/TRC–1 in unlettered models).	1		Transmitter	Receiver.
2	CD–800 or CG–107/U	Up to 3	35, 50, or 65 ft.	Transmitter	Antenna.
3	CD–800 or CG–107/U	Up to 3	35, 50, or 65 ft.	Receiver	Antenna.
4	PC1	1	10 ft.	Transmitter	Junction Box JB–110.
5	PC101	1	10 ft.	Receiver	Junction Box JB–110.
6	CD–711	1	50 ft.	Power unit or Junction Box J–85/G.	Junction Box JB–110.
7	Spiral-four cable		Up to 5 miles.	Transmitter	Telephone terminal.

103. Repacking Terminal Set for Man Transport

a. Radio Terminal Set AN/TRC–3(*) can be broken down readily into units or bundles which can be man-carried. In this way it is possible to get the radio equipment to an otherwise inaccessible spot.

b. Basically the radio set is broken down into bundles and carried with the use of the antenna mast sections and carrying Straps ST–18. Power Unit PE–75–(*) can be disassembled into three easily carried units (generator and tool box, engine, and frame) by two men in approximately 15 minutes.

c. The following instructions for man-packing Radio Terminal Set AN/TRC–3(*) are based upon a team of six men. Normally, one man is left at the point from which the equipment must be man-packed. His function is to guard and assist in sorting the equipment into the necessary bundles. One man stays at the station location after his first trip to assemble the equipment as it is carried in by the other two-man teams. Since the various models of the equipment differ slightly in component pieces, and since a working team may not always comprise six men, there will be deviations from these instructions which will have to be made to meet the existing circumstances. The intent of the following instructions is to show the manner in which the equipment can be bundled and man-packed into position without all the exact details covering differences of models.

d. Trips No. 1 through 5 of the following provide for carrying in the minimum number of components necessary to get the radio terminal station in operation, except for the quantity of spiral-four cable necessary to connect the radio set to the telephone carrier equipment when a multichannel system is being set up.

e. Trips No. 6 through 25 place 5 miles of spiral-four cable at the terminal station location. The number of these trips and the destination of each trip will depend on the situation and the manner planned for laying the cable. Reels should be dropped ¼ mile apart along the path of the proposed circuit (if known). Normally,

the telephone carrier or wire teams would lay the spiral-four cable to the site of the radio terminal. It is advisable, however, for the radio team to carry at least one reel of spiral-four cable and one Cable Stub CC–356–(*), if possible, so as to take care of the possibility that the wire team has laid the cable to the site ahead of time and did not terminate the spiral-four cable at the exact spot where the radio equipment is to be set up.

f. When repacking Radio Terminal Set AN/TRC–3G, note that the following changes have been made in the components listed:

(1) Case CY–29(*)/TRC–1 has been replaced by Cases CY–433/TRC–1, Carrying Frame CY–445/TRC–1, and Bag BG–102–(*).

(2) Maintenance Equipment MK–5(*)/TRC–3 has been deleted and Accessory Kits No. 1 and 2 have been added. Each accessory kit is packed in a Chest BC–5 or CY–64/U.

(3) The scissors horse, the star drill, and other minor components have been deleted.

(4) Case CY–30(*)/TRC–1 has been replaced by Case CY–790/TRC–1 or Case CY–444/TRC–1 and Bag BG–102–(*).

g. Following is a list of trips and items carried on each trip, based on a team of six men:

(1) *Trip No. 1.* Four men take two Cases CY–30(*)/TRC–1, containing, in addition to normal contents—
1 Junction Box JB–110
1 Cord CD–711
1 gasoline can nozzle
1 pulley block, double sheave
1 star drill
8 guy Stakes GP–25
5 guy plates
1 Test Oscillator TS–32(*)/TRC–1
2 guy Stakes GP –2
Each case carried by (slung from)—
1 mast section (wt 215 lb, total for both cases)
One man takes six Stakes GP–25, using—
2 Straps ST–18
(wt 55 lb)
Four men returning from trip No. 1 bring back—
2 Straps ST–18

(2) *Trip No. 2.* Two men take—
1 Power Unit PE–75–(*) frame
1 five-gallon can of gasoline
1 Hammer HM–3
1 scissors horse
8 guys, 50 ft
8 guys, 37 ft, using:
2 mast sections
4 Straps ST–18
(wt 160 lb)
Two men take one Power Unit PE–75–(*) engine, using—
2 mast sections
2 Straps ST–18
(wt 155 lb)
Four men returning from trip No. 2 bring back six Straps ST–18.

(3) *Trip No. 3.* Two men take one Power Unit PE–75–(*) generator, tool box, and belts, using—
2 mast sections
2 Straps ST–18
(wt 148 lb)
Two men take—
7 mast sections
2 mast bases
1 Axe LC–1
150-ft rope with pulley block, single sheave
(wt 120 lb)
Four men returning from trip No. 3 bring back two Straps ST–18.

(4) *Trip No. 4.* Two men take one Radio Transmitter T–14(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 130 lb)
Two men take one Radio Receiver R–19(*)/TRC–1, using—
2 mast sections
4 Straps ST-18
(wt 120 lb)
Four men returning from trip No. 4 bring back eight Straps ST–18.

(5) *Trip No. 5.* Two men take two 5-gallon cans of gasoline, using—
1 mast section
2 Straps ST–18
(wt 90 lb)

Two men take one 5-gallon can of gasoline and one 5-gallon can of oil, using—
1 mast section
2 Straps ST–18
(wt 95 lb)

Four men returning from trip No. 5 bring back two Straps ST–18.

(6) *Trips No. 6 through 25.* Four men take one reel, spiral-four, using—
Reel RL–31–(*)
(wt 190 lb)

Four men returning from trip No. 25 (or last trip of cable) bring back two Cases CY–30(*)/TRC–1 empty, using—
2 mast sections
(wt 80 lb total)

(7) *Trip No. 26.* Two men take one Case CY–30(*)/TRC–1, containing—
2 Stakes GP–25
3 guy plates
2 guys, 50 ft
2 guys, 37 ft
1 Hammer HM–3
1 Axe LC–1
1 star drill
2 guy Stakes GP–2
2 Hammers HM–1
Using—
1 mast section
(wt 93 lb)

Two men take one Case CY–30(*)/TRC–1, containing—
150-foot rope with pulley block, single sheave
1 pulley block double sheave
3 Telephones EE–8–(*)
Using—
1 mast section
(wt 95 lb)

Four men returning from trip No. 26 bring back two mast sections (wt. 20 lb)

(8) *Trip No. 27.* Two men take—
1 Power Unit PE–75–(*) frame
1 scissors horse
5-gallon can of gasoline
Using—
2 mast sections
2 Straps ST–18
(wt 155 lb)

Four men returning from trip No. 27 bring back—
4 mast sections
2 Straps ST–18
(wt 42 lb)

(9) *Trip No. 28.* Two men take one Power Unit PE–75–(*) generator, tool box, and belts, using—
2 mast sections
2 Straps ST–18
(wt 148 lb)

Two men take one Power Unit PE–75–(*) frame with Case CY–44/TRC–3 using—
2 mast sections
2 Straps ST–18
(wt 105 lb)

Four men returning from trip No. 28 bring back—
4 Straps ST–18
4 mast sections
(wt 44 lb)

(10) *Trip No. 29.* Two men take one Power Unit PE–75–(*) engine, using—
2 mast sections
2 Straps ST–18
(wt 155 lb)

Two men take one Power Unit PE–75–(*) generator, tool box, and belts, using—
2 mast sections
2 Straps ST–18
(wt 148 lb)

Four men returning from trip No. 29 bring back—
4 mast sections
4 Straps ST–18
(wt 44 lb)

(11) *Trip No. 30.* Two men take one Radio Receiver R–19(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 120 lb)

Two men take one Radio Transmitter T–14(*)/TRC–1, using—
- 2 mast sections
- 4 Straps ST–18
- (wt 130 lb)

Four men returning from trip No. 30 bring back—
- 4 Straps ST–18
- 4 mast sections
- (wt 44 lb)

(12) *Trip No. 31.* Two men take one Maintenance Equipment MK–5(*)/TRC–3, using—
- 2 mast sections
- 4 Straps ST–18
- (wt 142 lb)

Two men take—
- 1 Junction Box J–85G
- 1 Case CY–29(*)/TRC–1 empty,
  - Using—
    - 2 mast sections
    - (wt 85 lb)

Three men returning from trip No. 31 bring back—
- 4 mast sections
- 2 Straps ST–18

(13) *Trip No. 32.* Two men take one carrying Case CY–29(*)/TRC–1, empty, using—
- 2 mast sections
- (wt 75 lb)

Two men take one Case CY–44/TRC–3 with crystal bank, using—
- 2 mast sections
- 2 Straps ST–18

104. Hand Cart M3A4 Transportation of Radio Terminal Set AN/TRC–3(*)

a. Radio Terminal Set AN/TRC–3(*) can also be transported into the operating location using Hand Cart M3A4. The radio equipment is broken down into suitable bundles in a manner similar to that for man-packing, except that less disassembly of the equipment is required.

b. The following instructions for carrying Radio Terminal Set AN/TRC–3(*) are based upon a six-man team. There may be a slight deviation from these instructions, in order to take care of the differences in models and upon the existing circumstances. The intent of the following instructions is to show the general procedure for getting the radio equipment into position using Hand Cart M3A4.

c. Trips No. 1 through 5 provide the minimum components necessary to place the radio station in operation. The same information concerning the spiral-four cable given in paragraph 103*e* for man-packing also applies to hand-cart packing.

d. Following is a list of trips and items carried on each trip, based on a six-man team.

(1) *Trip No. 1.* Five men take one Power Unit PE–75–(*) complete, using—
- 4 Straps ST–18
- 150-ft rope with pulley for towing
- (wt 324 lb)

Four men returning from trip No. 1 bring back—
- 1 Hand Cart M3A4
- 4 Straps ST–18
- (wt of cart 77.5 lb)

(2) *Trip No. 2.* Four men take two Cases CY–30(*)/TRC–1 complete, containing following additional equipment:
- 1 Junction Box JB–110
- 1 Cord CD–711
- 1 Test Oscillator TS–32(*)/TRC–1
- 1 gasoline can nozzle
- 5 guy plates
- 1 pulley block, double sheave
- 1 star drill
- 8 guy Stakes GP–2
  - Using—
    - 4 Straps ST–18
    - (wt 212 lb)

Four men returning from trip No. 2 bring back—
- 1 Hand Cart M3A4
- 4 Straps ST–18

(3) *Trip No. 3.* Four men take—
- 19 mast sections
- 8 guys, 50 ft
- 8 guys, 37 ft
- 1 scissors horse
- 1 Hammer HM–3
- 4 Stakes GP–25
  - Using—
    - 6 Straps ST–18
    - (wt 250 lb)

Four men returning from trip No. 3 bring back—

1 Hand Cart M3A4
6 Straps ST–18

(4) *Trip No. 4.* Four men take—

3 five-gallon cans of gasoline
2 mast bases
4 Stakes GP–25
1 Axe LC–1
Using—
8 Straps ST–18
(wt 225 lb)

Four men returning from trip No. 4 bring back—-

1 Hand Cart M3A4
8 Straps St–18

(5) *Trip No. 5.* Four men take—

1 Radio Transmitter T–14(*)/TRC–1
1 Radio Receiver R–19(*)/TRC–1, using—
8 Straps ST–18 (wt 203 lb)

Four men returning from trip No. 5 bring back—

1 Hand Cart M3A4
8 Straps St–18

Spiral-four cable in the amount required should be taken after trip No. 5. Each trip can take one-fourth mile on Reel RL–31, using four Straps ST–18; weight for each trip 190 lb. Reels should be dropped one-fourth mile apart along the path of the proposed circuit (if known).

(6) *Trip No. 6 (or first trip after taking the spiral-four cable).*

Four men take one Case CY–29(*)/TRC–1, containing—

3 mast sections
2 Stakes GP–25
3 guy plates
2 guys, 50 ft
2 guys, 37 ft
1 Hammer HM–3
1 Axe LC–1
1 star drill
2 guy Stakes GP–2
1 pulley block, double sheave
150-foot rope with pulley
3 Telephones EE–8–(*)
2 Hammers HM–1
1 scissors horse
1 Case CY–67/TRC–1
Using—
8 Straps ST–18
(wt 180 lb)

Four men returning from trip No. 6 bring back—

1 Hand Cart M3A4
8 Straps ST–18

(7) *Trip No. 7.* Four men take one Power Unit PE–75–(*), complete, using—

4 Straps ST–18
(wt 324 lb)

Four men returning from trip No. 7 bring back—

1 Hand Cart M3A4
4 Straps ST–18

(8) *Trip No. 8.* Four men take one Power Unit PE–75–(*), complete, using—

4 Straps ST–18
(wt 324 lb)

Four men returning from trip No. 8 bring back—

1 Hand Cart M3A4
4 Straps ST–18

(9) *Trip No. 9.* Four men take—

1 Radio Transmitter T–14(*)/TRC–1
1 Radio Receiver R–19(*)/TRC–1
Using—
8 Straps ST–18
(wt 203 lb)

Four men returning from trip No. 9 bring back—

1 Hand Cart M3A4
8 Straps ST–18

(10) *Trip No. 10.* Four men take—

1 Junction Box J–85/G
1 Maintenance Equipment MK–5(*)/TRC–3, using—
2 Straps ST–18
(wt 132 lb)

Four men returning from trip No. 10 bring back—

1 Hand Cart M3A4
2 Straps ST–18

(11) *Trip No. 11.* Four men take—

2 five-gallon cans of gasoline

1 five-gallon can of oil
1 Case CY–44/TRC–3
Using—
6 Straps ST–18
(wt 210 lb)

Two men returning from trip No. 11 bring back—
1 Hand Cart M3A4
6 Straps ST–18

(12) *Trip No. 12.* Two men take one Case CY–29(*)/TRC–1, empty, using—
8 Straps St–18
(wt 140 lb)

e. Note the changes in components listed in paragraph 103*f* when making up loads for transportation of Radio Terminal Set AN/TRC–3G.

Section V. INSTALLATION OF RADIO RELAY SET AN/TRC–4(*)

105. Location of Radio Set and Power Supply

For information pertaining to the location of Radio Relay Set AN/TRC–4(*) and Power Unit PE–75–(*), see paragraphs 52, 53, 57, and 60.

106. Uncrating, Unpacking, and Checking

For information pertaining to unpacking and uncrating the components of Radio Relay Set AN/TRC–4(*), see paragraph 61. Items included should be checked against packing lists.

107. Installation of Transmitters and Receivers

The installation of Radio Relay Set AN/TRC–4(*) is identical to the installation of Radio Terminal Set AN/TRC–3(*) except that the complete radio-relay installation consists of two transmitters, two receivers, four antennas, and spares to insure 24-hour operation. Line of sight in two directions is needed for the antenna installations.

108. Connections for Single-Channel Simplex Relay Station

The cording for single-channel simplex relay operation is similar to that for the duplex terminal station shown in figure 76. The only difference is that simplex relay operation requires that the jumper wires between the REC. and TRSG. binding posts be connected, while for duplex terminal operation they are not connected.

109. Connections for Single-Channel Duplex Relay Station

Single-channel duplex operation requires two receivers, two transmitters, and four antennas. Connections and interconnections (fig. 77) are as follows:

a. Cord CD–711 (50-foot) is used to connect Junction Box J–85/G at the power unit to the cord from Junction Box JB–110 at the radio station.

b. Receiver power cords PC101 are 10-foot cords which lead from the A-C LINE of Radio Receivers R–19(*)/TRC–1 and plug into Junction Box JB–110.

c. Transmitter power cords PC1 are 10-foot cords which lead from the A-C LINE of Radio Transmitter T–14(*)/TRC–1 and plug into Junction Box JB–110.

d. Cords CX–104/TRC–1 or CX–8/TRC–1 are used to interconnect Radio Receivers R–19(*)/TRC–1 with Radio Transmitters T–14(*)/TRC–1. Make sure the receiver receiving from one direction is connected to the transmitter relaying forward in the same direction.

e. Two short jumper wires are used for connecting the two spiral-four cable binding posts marked REC. to the two binding posts marked TRSG. on each transmitter as shown in figure 77.

f. Cords CD–800 or CG–107/U are used for connecting the antenna to Radio Receivers R–19(*)/TRC–1. The cords are fitted at each end with Plugs PL–259–(*). The plugs on one end of the cords are inserted into the ANT. IN-

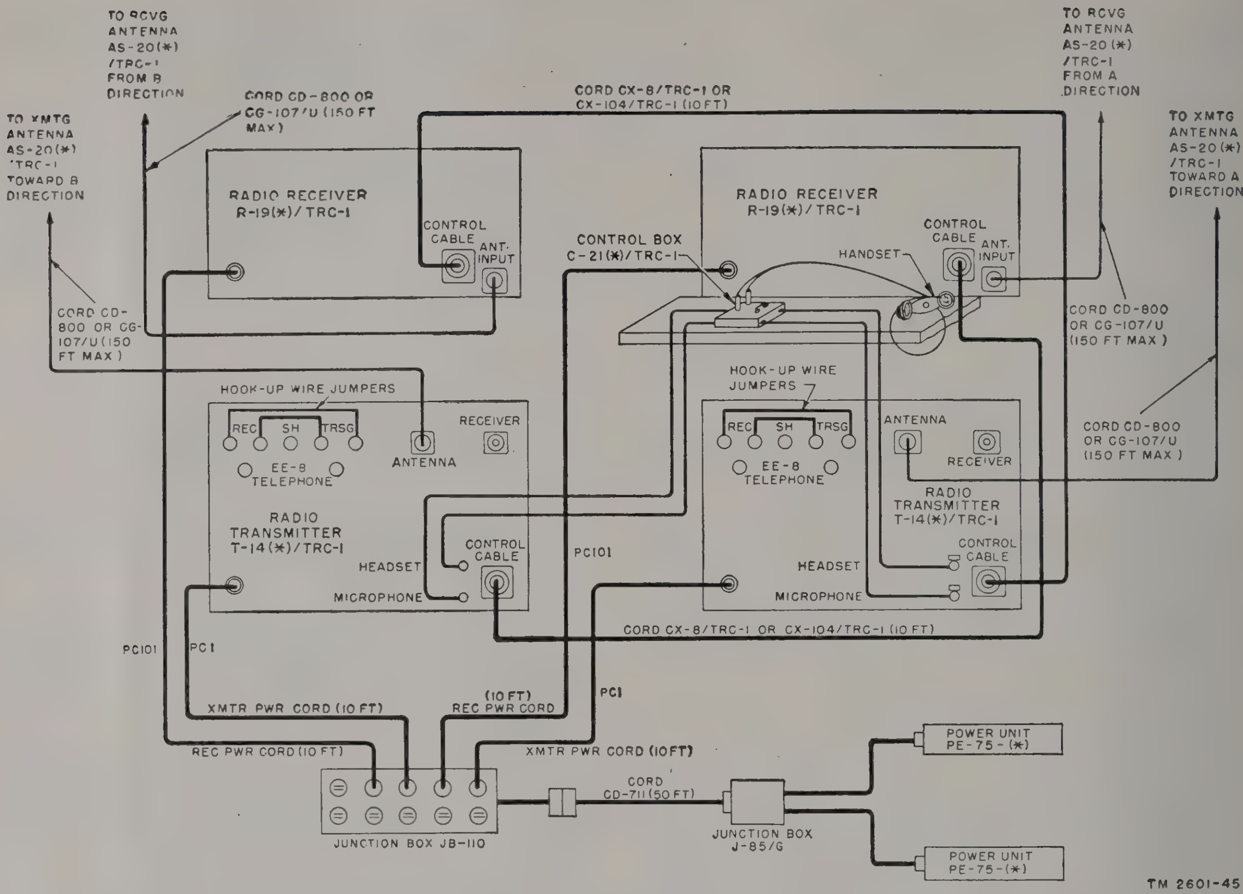

Figure 77. Radio Relay Set AN/TRC-4(*) as a duplex relay station, cording diagram.

PUT receptacles on the front receiver panels, and the plugs on the other end are inserted into the receptacles on Antennas AS–20(*)/TRC–1. Cords CD–800 or CG–107/U are also used for connecting the transmitting antennas to the transmitters (or amplifiers AM–8(*)/TRA–1) in the same manner.

g. Plugs PL–55 and PL–68, extending from the left-hand end of Control Box C–21(*)/TRC–1, are inserted into the HEADSET and MICROPHONE jacks on the transmitter, transmitting toward terminal A. Plugs PL–55 and PL–68, extending from the right-hand end of Control Box C–21(*)/TRC–1, should be inserted into the HEADSET and MICROPHONE jacks on the transmitter which is transmitting toward terminal B. Plugs PL–55 and PL–68 of handset should be plugged into the HEADSET and MICROPHONE jacks of Control Box C–21(*)/TRC–1 (fig. 77).

h. If the relay station is assembled from components of Radio Sets AN/TRC–1(*) or Radio Terminal Sets AN/TRC–3(*), Control Box C–21(*)/TRC–1 will not be available and two handsets must be used, plugged directly into the jacks at the transmitters.

110. Connections for Multichannel Duplex Relay Station

Connections and interconnections (fig. 77) for multichannel duplex relay operation are the same as for single-channel duplex relay operation. Table XI lists the various cords.

111. Repacking Radio Relay Set for Man Transport

a. Radio Relay Set AN/TRC–4(*) can be broken down into units or bundles tied with Carrying Straps ST–18. These packages can be carried by two men using the mast sections of Antenna Systems AS–19(*)/TRC–1. Power Units PE–75–(*) can be disassembled into

Table XI. Cording Radio Relay Set AN/TRC-4(*) for Operation as a Duplex Relay Station in a Single-Channel or Multichannel System

Cable No.	Cord	No. req.	Length (ft.)	Connects	
				From	To
1	CX-104/TRC-1 (CX-8/TRC-1 in unlettered models).	1	10	Transmitter (Channel A).	Receiver (Channel B).
2	CX-104/TRC-1 (CX-8/TRC-1 in unlettered models).	1	10	Transmitter (Channel B).	Receiver (Channel A).
3	CD-800 or CG-107/U	Up to 3	35, 50, or 65	Transmitter (Channel A).	Antenna (Channel A).
4	CD-800 or CG-107/U	Up to 3	35, 50, or 65	Transmitter (Channel B).	Antenna (Channel B).
5	CD-800 or CG-107/U	Up to 3	35, 50, or 65	Receiver (Channel A).	Antenna (Channel A).
6	CD-800 or CG-107/U	Up to 3	35, 50, or 65	Receiver (Channel B).	Antenna (Channel B).
7	PC1	1	10	Transmitter (Channel A).	Junction Box JB-110.
8	PC1	1	10	Transmitter (Channel B).	Junction Box JB-110.
9	PC101	1	10	Receiver (Channel A).	Junction Box JB-110.
10	PC101	1	10	Receiver (Channel B).	Junction Box JB-110.
11	CD-711	1	50	Junction Box JB-110.	Junction Box J-85/G.

three easily carried units (generator and tool box, engine, and frame) by two men in approximately 15 minutes.

b. The following instructions for man-packing Radio Relay Set AN/TRC-4(*) are based upon a team of six men. Normally, one man is left at the point from which the equipment is man-packed. His function is to guard and assist in sorting the equipment into the necessary bundles. One man stays at the station location after his first trip to assemble the equipment as it is carried in by the other two-man teams. Since the various models of the equipment differ slightly in component pieces, and since a working team may not always comprise six men, there will be deviations from these instructions which will have to be made to meet the existing circumstances. The intent of the following instructions is to show the manner in which the equipment can be bundled and man-packed into position without all the exact details covering differences of models.

c. Following is list of trips and items carried on each trip based on a team of six men.

d. Trips 1 through 7 provide the minimum number of components necessary to place the radio relay station in operation.

(1) *Trip No. 1.* Four men take two Cases CY-30(*)/TRC-1, containing in addition to normal contents—

- 1 Junction Box JB-110
- 1 Cord CD-711
- 1 gas can nozzle
- 1 pulley block, double sheave
- 1 star drill
- 4 guy plates
- 2 guy Stakes GP-25
- Test Oscillator TS-32(*)/TRC-1

Each case carried by—

- 1 mast section

(wt 206 lb total for both cases)

One man takes six guy Stakes GP-25, using—

- 2 Straps ST-18

(wt 55 lb)

Four men returning from trip No. 1 bring back two Straps ST-18.

(2) *Trip No. 2.* Four men take two Cases CY-30(*)/TRC-1, containing in addition to normal contents—

- 8 guy Stakes GP-25
- 5 guy plates

16 guy Stakes GP–2
Each case carried by—
1 mast section
(wt 259 lb total for both cases)
Four men return from trip No. 2.

(3) *Trip No. 3.* Two men take—
1 Power Unit PE–75–(*) frame
1 five-gallon can of gasoline
1 Hammer HM–3
16 guys 50 ft
16 guys 37 ft carried by—
2 mast sections using—
4 Straps ST–18
(wt 155 lb)
Two men take one Power Unit PE–75–(*) engine, using—
2 mast sections
2 Straps ST–18
(wt 155 lb)
Four men returning from trip No. 3 bring back six Straps ST–18.

(4) *Trip No. 4.* Two men take one Power Unit PE–75–(*) generator, tool box, and belt, using—
2 mast sections
2 Straps ST–18
(wt 148 lb)
Two men take—
1 scissors horse
7 mast sections
1 Axe LC–1 using—
4 Straps ST–18
(wt 113 lb)
Four men returning from trip No. 4 bring back six Straps ST–18.

(5) *Trip No. 5.* Two men take eight mast sections, using—
2 Straps ST–18
(wt 80 lb)
Two men take—
10 Stakes GP–25
150-foot rope with pulley
2 mast bases
2 mast sections
Using—
2 Straps ST–18
(wt 139 lb)
Four men returning from trip No. 5 bring back four Straps ST–18.

(6) *Trip No. 6.* Two men take one Radio Transmitter T–14(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 130 lb)
Two men take one Radio Transmitter T–14(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 130 lb)
Four men returning from trip No. 6 bring back eight Straps ST–18.

(7) *Trip No. 7.* Two men take one Radio Receiver R–19(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 120 lb)
Two men take one Radio Receiver R–19(*)/TRC–1, using—
2 mast sections
4 Straps ST–18
(wt 120 lb)
Four men returning from trip No. 7 bring back four Straps ST–18.

(8) *Trip No. 8.* Two men take one Power Unit PE–75–(*) frame with two 5-gallon cans of gasoline, using—
2 mast sections
4 Straps ST–18
(wt 151 lb)
Two men take one Power Unit PE–75–(*) engine, using—
2 mast sections
2 Straps ST–18
(wt 155 lb)
Four men returning from trip No. 8 bring back six Straps ST–18.

(9) *Trip No. 9.* Two men take one Power Unit PE–75–(*) frame with two 5-gallon cans of gasoline, using—
2 mast sections
4 Straps ST–18
(wt 151 lb)
Two men take one Power Unit PE–75–(*) generator, tool box, and belts, using—
2 mast sections
2 Straps ST–18
(wt 148 lb)

Four men returning from trip No. 9 bring back—

- 3 mast sections
- 6 Straps ST–18
- (wt 30 lb)

(10) *Trip No. 10.* Two men take one Power Unit PE–75–(*) engine, using—

- 2 mast sections
- 2 Straps ST–18
- (wt 155 lb)

Two men take one Power Unit PE–75–(*) generator, tool box, and bolts, using—

- 2 mast sections
- 2 Straps ST–18
- (wt 148 lb)

Four men returning from trip No. 10 bring back —

- 4 mast sections
- 4 Straps ST–18
- (wt 44 lb)

(11) *Trip No. 11.* Two men take one Case CY–29(*)/TRC–1, containing—

- 7 guy plates
- 4 50-foot guys
- 4 37-foot guys
- 2 Hammers HM–3
- 4 Axes LC–1
- 4 guy Stakes GP–2
- 3 star drills
- 1 pulley block, double sheave
- 150-foot rope with pulley, carried with—
  - 2 mast sections
  - (wt 131 lb)

Two men take one Case CY–29(*)/TRC–1, containing—

- 2 pulley blocks, double sheave
- 2 150-foot ropes with pulleys
- 4 Hammers HM–1
- 3 Telephones EE–8–(*)
- 1 Control Box C–21(*)/TRC–1, carried with—
  - 2 mast sections
  - (wt 131 lb)

Four men returning from trip No. 11 bring back—

- 4 mast sections
- 2 Straps ST–18
- (wt 42 lb)

(12) *Trip No. 12.* Two men take one Radio Transmitter T–14(*)/TRC–1, using—

- 2 mast sections
- 4 Straps ST–18
- (wt 130 lb)

Two men take one Radio Receiver R–19(*)/TRC–1, using—

- 2 mast sections
- 4 Straps ST–18
- (wt 120 lb)

(13) *Trip No. 13.* Two men take one chest of Maintenance Equipment MK–6(*)/TRC–4, using—

- 2 mast sections
- 4 Straps ST–18
- (wt 140 lb)

Four men returning from trip No. 13 bring back—

- 4 Straps ST–18
- 4 mast sections
- (wt 44 lb)

(14) *Trip No. 14.* Two men take—

- 1 Junction Box J–85/G
- 1 five-gallon can of oil
- 4 Stakes GP–25, using—
  - 2 mast sections
  - 4 Straps ST–18
  - (wt 130 lb)

Two men take one Case CY–29(*)/TRC–1, containing—

- 3 scissors horses, using—
  - 2 mast sections
  - (wt 110 lb)

One man returning from trip No. 14 brings back two mast sections.

(15) *Trip No. 15.* Two men take one Case CY–29(*)/TRC–1, empty, using two mast sections (wt 73 lb).

112. Hand Cart M3A4 Transportation of Radio Relay Set AN/TRC–4(*)

a. Radio Relay Set AN/TRC–4(*) can also be transported into the operating location using Hand Cart M3A4. The radio equipment is broken down into suitable bundles in a manner similar to that for man-packing except that less disassembly of the equipment is required.

b. The following instructions for carrying Radio Relay Set AN/TRC–4(*) are based upon

a six-man team. Slight deviations will be necessary in order to account for the differences in models and existing circumstances. The intent of the following instructions is to show the general procedure for getting the radio equipment into position using Hand Cart M3A4.

c. Following is a list of trips and items carried on each trip based on a team of six men.

d. Trips 1 through 8 provide the minimum components necessary to put the radio-relay station into operation.

(1) *Trip No. 1.* Five men take one Power Unit PE–75–(*) complete, using—
 4 Straps ST–18
 150-foot rope with pulley
 (wt 324 lb)
Four men returning from trip No. 1 bring back—
 1 Hand Cart M3A4 (weight of cart 77.5 lb)
 4 Straps ST–18

(2) *Trip No. 2.* Four men take two Cases CY–30(*)/TRC–1 complete, containing the following additional equipment:
 2 mast bases
 1 scissors horse
 1 Junction Box JB–110
 1 Test Oscillator TS–32(*)/TRC–1
 16 guy Stakes GP–2
 1 gasoline can nozzle, using—
  8 Straps ST–18 (wt 220 lb)
Four men returning from trip No. 2 bring back—
 1 Hand Cart M3A4
 8 Straps ST–18

(3) *Trip No. 3.* Four men take two Cases CY–30(*)/TRC–1 complete, containing the following additional equipment:
 2 mast bases
 1 Cord CD–711
 9 guy plates
 1 pulley block, double sheave
 1 star drill, using—
  8 Straps ST–18 (wt 202 lb)
Four men returning from trip No. 3 bring back—
 1 Hand Cart M3A4
 8 Straps ST–18

(4) *Trip No. 4.* Four men take—
 6 mast sections
 16 guys, 50 ft
 16 guys, 37 ft
 1 Hammer HM–3
 1 Axe LC–1
 12 guy Stakes GP–25, using—
  6 Straps ST–18
  (wt 209 lb)
Four men returning from trip No. 4 bring back—
 1 Hand Cart M3A4
 6 Straps ST–18

(5) *Trip No. 5.* Four men take 20 mast sections, using—
 8 Straps ST–18
 (wt 200 lb)
Four men returning from trip No. 5 bring back—
 1 Hand Cart M3A4
 8 Straps ST–18

(6) *Trip No. 6.* Four men take—
 9 mast sections
 4 guy Stakes GP–25
 2 five-gallon cans of gasoline, using—
  8 Straps ST–18
  (wt 192 lb)
Four men returning from trip No. 6 bring back—
 1 Hand Cart M3A4
 8 Straps ST–18

(7) *Trip No. 7.* Four men take—
 1 Radio Transmitter T–14(*)/TRC–1
 1 Radio Receiver R–19(*)/TRC–1, using—
  8 Straps ST–18
  (wt 203 lb)
Four men returning from trip No. 7 bring back—
 1 Hand Cart M3A4
 8 Straps ST–18

(8) *Trip No. 8.* Four men take—
 1 Radio Transmitter T–14(*)/TRC–1
 1 Radio Receiver R–19(*)/TRC–1, using—
  8 Straps ST–18
  (wt 203 lb)
Four men returning from trip No. 8 bring back—

1 Hand Cart M3A4
8 Straps ST–18

(9) *Trip No. 9.* Four men take one Power Unit PE–75–(*), complete, using—
4 Straps ST–18
(wt 324 lb)
Four men returning from trip No. 9 bring back—
1 Hand Cart M3A4
4 Straps ST–18

(10) *Trip No. 10.* Four men take one Power Unit PE–75–(*), complete, using 4 Straps ST–18 (wt 324 lb)
Four men returning from trip No. 10 bring back—
1 Hand Cart M3A4
4 Straps ST–18

(11) *Trip No. 11.* Four men take—
1 Junction Box J–85/G
1 Radio Transmitter T–14(*)/TRC–1
1 Radio Receiver R–19(*)/TRC–1, using—
8 Straps ST–18
(wt 203 lb)
Four men returning from trip No. 11 bring back—
1 Hand Cart M3A4
8 Straps ST–18

(12) *Trip No. 12.* Four men take—
3 five-gallon cans of gasoline
1 five-gallon can of oil, using—
8 Straps ST–18
(wt 208 lb)
Four men returning from trip No. 12 bring back—
1 Hand Cart M3A4
8 Straps ST–18

(13) *Trip No. 13.* Four men take one chest of Maintenance Equipment MK–6(*)/TRC–4, using—
4 mast sections
4 Straps ST–18
(wt 190 lb)
Four men returning from trip No. 13 bring back—
1 Hand Cart M3A4
4 Straps ST–18

(14) *Trip No. 14.* Four men take—
1 chest of Maintenance Equipment MK–6(*)/TRC–4
5 mast sections, using—
4 Straps ST–18
(wt 170 lb)
Four men returning from trip No. 14 bring back—
1 Hand Cart M3A4
4 Straps ST–18

(15) *Trip No. 15.* Four men take one Case CY–29(*)/TRC–1, containing—
4 Stakes GP–25
4 guy plates
4 guys, 50 ft
4 guys, 37 ft
3 Hammers HM–3
3 Axes LC–1
3 star drills
4 guy Stakes GP–2
3 pulley blocks, double sheave
4 Hammers HM–1
1 Control Box C–21/TRC–1, using—
8 Straps ST–18
(wt 202 lb)
Four men returning from trip No. 15 bring back—
1 Hand Cart M3A4
8 Straps ST–18

(16) *Trip No. 16.* Four men take one Case CY–29(*)/TRC–1, containing—
3 ropes, 150 ft with pulley
3 scissors horses
3 Telephones EE–8–(*), using—
8 Straps ST–18 (wt 196 lb)
Two men returning from trip No. 16 bring back—
1 Hand Cart M3A4
8 Straps ST–18

(17) *Trip No. 17.* Two men take one Case CY–29(*)/TRC–1, empty, using—
8 Straps ST–18 (wt 53 lb)
Two men returning from trip No. 17 bring back—
1 Hand Cart M3A4
8 Straps ST–18

(18) *Trip No. 18.* Two men take one Case CY–29(*)/TRC–1, empty, using eight Straps ST–18 (wt 53 lb)

e. Note the changes in the components listed in paragraph 103*f* when making up loads for transportation of Radio Relay Set AN/TRC–4G.

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113. Location of Amplifer Equipment

Amplifier Equipment AN/TRA–1(*) is issued and used for unusual operating conditions where more power is required to maintain good communication under adverse conditions, such as unfavorable terrain or long spans between stations. Amplifier AM–8(*)/TRA–1 is housed in Case CY–15/TRA–1, and Power Supply PP–13(*)/TRA–1 is housed in Case CY–16/TRA–1 when in transit or field use. The front cover must be open under operating conditions, and a rain shelter must be provided for inclement weather. Amplifier AM–8(*)/TRA–1, Radio Transmitter T–14(*)/TRC–1, and Power Supply PP–13(*)/TRA–1 are proportioned so that they may be stacked as shown in figure 4. Interconnecting cables are of sufficient length to permit such an arrangement.

114. Uncrating, Unpacking, and Checking

For domestic shipment, all pieces of equipment are transportable in their cases and no special unpacking instructions are required (par. 61). The amplifier, upon arrival at sites, should be checked to see that tubes are firmly seated in their sockets (par. 128). Power supply tubes are packed in cartons and shipped in Case CY–16/TRA–1.

115. Installation of Amplifier and Power Supply

a. Place Amplifier AM–8(*)/TRA–1 and Power Supply PP–13(*)/TRA–1 in the positions shown in figure 4.

b. Open the front covers of Case CY–15/TRA–1 and Case CY–16/TRA–1. If the equipment is to be used in inclement weather, pull out the canvas protection hood over the front panel of Amplifier AM–8(*)/TRA–1.

c. Check to see that all tubes are in their proper sockets.

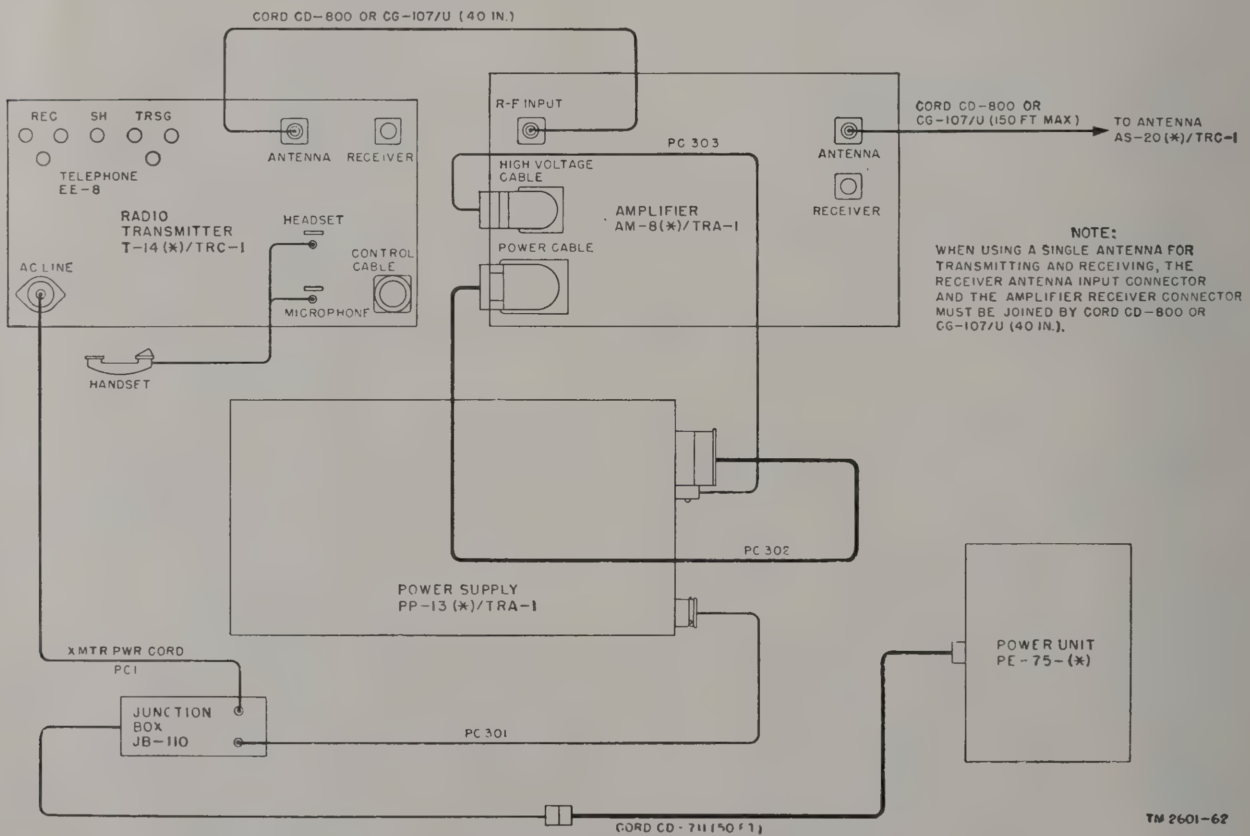


Figure 78. Amplifier Equipment AN/TRA–1, cording diagram.

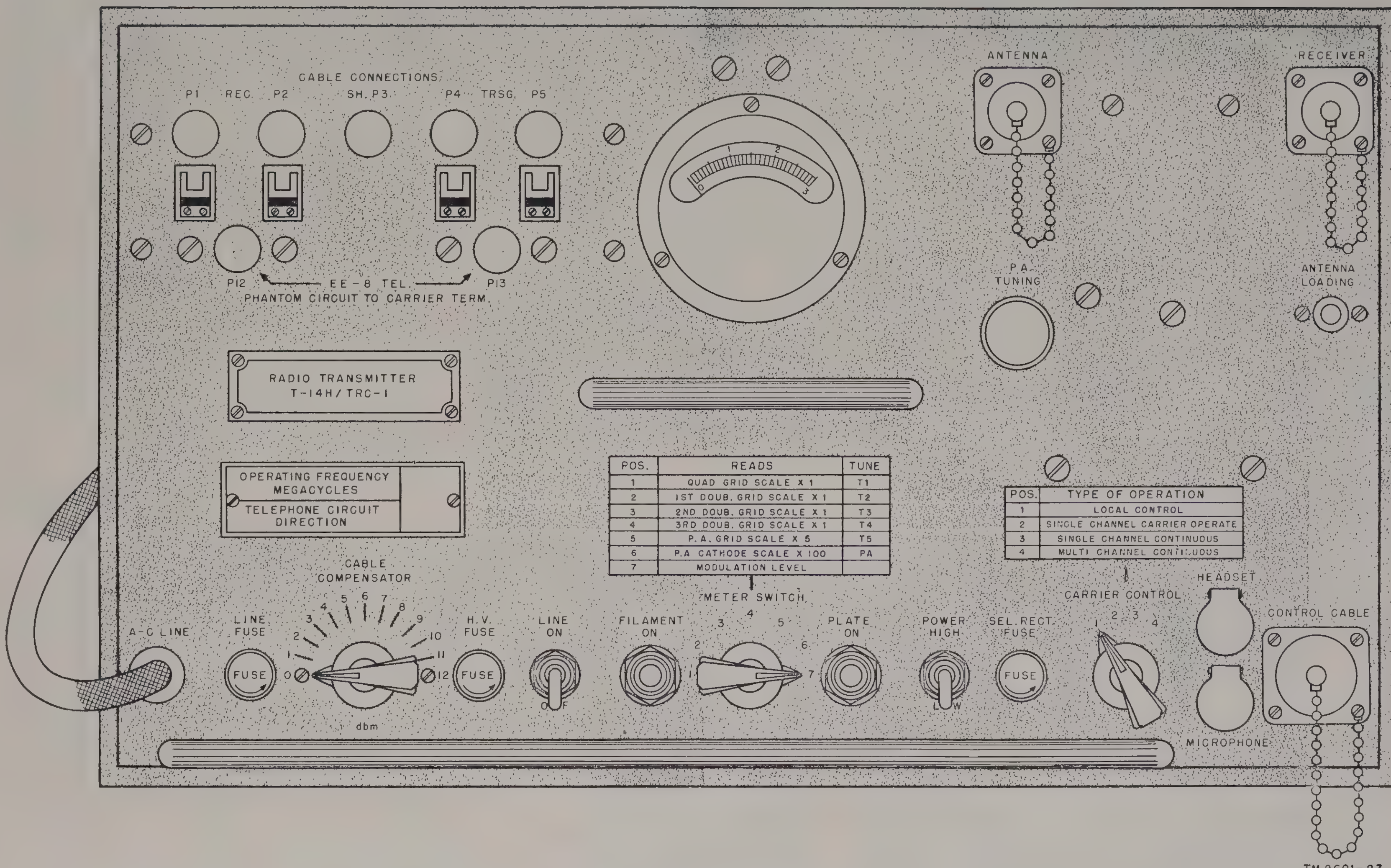


Figure 79. Radio Transmitter T–14H/TRC–1, front panel.

d. Connect the cords and cables as described in the following paragraph.

116. Connections and Interconnections

a. Amplifier AM–8(*)/TRA–1 and Power Supply PP–13(*)/TRA–1 are interconnected (fig. 78) by a multiconductor cable for power and control and by a single-conductor high-tension cable for plate power. These cables are permanently attached to the power supply on one end and are equipped with connectors on the other end to permit plugging into the amplifier.

b. The transmitting antenna is connected to the ANTENNA receptacle on Amplifier AM–8(*)/TRA–1 by Cord CD–800 or CG–107/U.

c. The ANTENNA output of Radio Transmitter T–14(*)/TRC–1 is fed to the R–F INPUT connector on Amplifier AM–8(*)/TRA–1 by means of Cord CD–800 or CG–107/U (40-inch).

d. If it is desired to use a single antenna for transmitting and receiving, the receiver ANT. INPUT connector and the amplifier RECEIVER connector must be joined by Cord CD–800 or CG–107/U. When the transmitting and receiving equipments are interconnected as described above, the HEADSET and MICROPHONE jacks on the front panel of Radio Transmitter T–14(*)/TRC–1 may be used to monitor the output of the associated receiver as well as to talk over the transmitter.

117. Service on Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 61 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes have been made, note the changes in this manual, preferably on the schematic diagram pertaining to the changed unit. Five modification work orders have been issued for modernization of various units.

c. Check the operating controls for ease of rotation. If lubrication is required, refer to the lubrication instructions in section III, chapter 4.

d. Perform the installation and connection procedures that apply for the particular installation. Refer to the appropriate paragraphs between paragraphs 63 and 116.

CHAPTER 3
OPERATION

Section I. CONTROLS AND INSTRUMENTS

118. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in the following sections of this chapter. For information on destroying the equipment to prevent enemy use, see Chapter 8.

119. Transmitter Controls

All of the *tuning* controls of Radio Transmitter T–14(*)/TRC–1, with the exception of the power amplifier stage tuning control (P. A. TUNING) and the antenna loading control (ANTENNA LOADING), are inside the cabinet on top of the chassis (fig. 88). All other controls, switches, and cable connections are found on the front panel (fig. 79). The function of each control on the front panel is described below.

a. A-C LINE. The primary power cord is brought into the radio transmitter through A-C LINE opening on the front panel.

b. LINE FUSE. The LINE FUSE protects the various components of the transmitter from damage that might be caused by shorts or excessive overloads.

c. CABLE COMPENSATOR SWITCH. The CABLE COMPENSATOR switch is used to adjust the amplification in the audio amplifier to compensate for attenuation in various lengths of telephone line or cable. The CABLE COMPENSATOR is calibrated in dbm and is set at the dial marking corresponding to the estimated line loss.

d. H.V. FUSE. This h-v 250-ma (375-ma in the H model) fuse protects transformer T8 and rectifier tubes V10 and V11. All h-v current is drawn through this fuse.

e. LINE ON-OFF SWITCH. In the ON position, the line switch connects 115-volt a-c primary power to the transmitter, and the green FILAMENT ON pilot lamp lights.

f. FILAMENT ON LAMP. This pilot lamp lights when the LINE ON-OFF switch is in the ON position, indicating that the filament power has been applied.

g. METER SWITCH. The METER SWITCH connects meter M1 to the various grid and plate circuits of the transmitter to facilitate tuning and operation. In the H model, a position also is provided on this switch to permit the use of meter M1 as a vacuum-tube voltmeter for checking modulation level at the output of the audio-amplifier section of tube V1.

h. PLATE ON LAMP. When the primary circuit of the h-v rectifiers is closed, the red PLATE ON pilot lamp is lighted.

i. POWER HIGH-LOW SWITCH. In the LOW POWER position, low screen voltage is applied to the type 829B p-a tube, limiting the plate current that can be drawn by this tube. It is useful in tuning because it limits the plate current of the p-a tube to a safe value. It also serves to reduce the r-f output of the transmitter from approximately 50 watts in the HIGH POWER position to less than 10 watts in the LOW POWER position when a 10-watt output provides satisfactory communications.

j. OTHER FUSES.

(1) *P.A. FUSE.* The power amplifier fuse is a 150- or 175-ma fuse that protects tube V9. If an overload is placed on either section of tube V9, and the current exceeds the safe value for the tube, the fuse will blow. This fuse is not used in the H model.

(2) *SEL. RECT. FUSE.* In Radio Transmitter T–14H/TRC–1, the P.A. FUSE is replaced by selenium rectifier fuse F4. This is a 250-ma fuse which protects the h-v transformer if the selenium rectifier becomes short-circuited.

k. CARRIER CONTROL SWITCH. The CARRIER CONTROL switch is a four-position switch. Setting this switch determines how the carrier is to be controlled.

(1) *Position 1, LOCAL CONTROL.* In this position, the carrier is turned on by pressing the switch on the handset and may be modulated 100 percent by speaking normally into the microphone.

(2) *Position 2, SINGLE CHANNEL CARRIER OPERATE.* When the switch is in this position, the carrier may be controlled remotely by land wires or by an incoming signal through the squelch circuit of the associated receiver. The local operator can communicate over the system with 100 percent modulation by using his handset.

(3) *Position 3.*

(*a*) *MULTICHANNEL CARRIER OPERATE.* In this position, the r-f carriers of the unlettered through E models of the transmitter are energized when either the carrier-operated relay in the associated receiver closes or when the handset switch is pressed. The carrier is controlled, therefore, by an incoming signal or by the switch on the handset. The handset modulates the transmitter only 30 percent under these conditions.

(*b*) *SINGLE CHANNEL CONTINUOUS.* In this position, the H model of the transmitter is on continuously. Channel 1 modulates the carrier 100 percent.

(4) *Position 4, MULTICHANNEL CONTINUOUS.* The carrier is on continuously when the switch is in this position. The operator may use channel 1, modulating the transmitter 30 percent without interfering with the other three communication channels being relayed through the circuit.

l. Headset and Microphone Jacks. The HEADSET jack receives Plug PL–55 of the handset or of Control Box C–21(*)/TRC–1. The MICROPHONE jack receives Plug PL–68 of the handset or of the control box.

m. Control Cable Receptacle. This receptacle engages the plug of Cord CX–8/TRC–1 or CX–104/TRC–1 used to interconnect the transmitter and receiver.

n. Cable Connections.

(1) *REC.* At a terminal station, the REC. binding posts connect to the receiving pair of spiral-four cable from carrier Telephone Terminal CF–1–(*). At a relay station, the REC. binding posts are connected to the TRSG. binding posts.

(2) *SH. ground.* This post connects to the shield of the spiral-four cables and also to a ground stake.

(3) *TRSG.* At a terminal station, this pair of binding posts receives the transmitting pair of spiral-four cable from carrier Telephone Terminal CF–1–(*). At a relay station, the TRSG. pair of binding posts are connected to the REC. pair of binding posts so that the receiver can modulate its associated transmitter.

(4) *TELEPHONE EE–8–(*)*. These posts connect to Telephone EE–8–(*) and enable communication between the terminal station and the telephone terminal by means of a phantom circuit over the spiral-four cable. These posts are marked EE–8 TEL. in the H model.

o. Receiver Receptacle. The RECEIVER receptacle engages the plug of the 40-inch Cord CD–800 or CG–107/U used for connecting the antenna circuit to the radio receiver.

p. Antenna Connector. This connector is the receptacle for the 50- 65-foot antenna transmission line Cord CD–800 or CG–107/U.

q. Antenna Loading Control. The inductive reactance of the antenna coupling circuit is balanced out by the reactance of fixed capacitor C42 and variable capacitor C41; capacitor C41 acts as an antenna loading adjustment.

r. P. A. Tuning Control. This control operates the capacitor used for tuning the p-a tank circuit.

120. Receiver Controls

The receiver front panel controls are explained in *a* through *r* below and are shown in figure 80. The *tuning* controls are shown in figure 89.

a. A-C Line. Primary power is brought into Radio Receiver R–19(*)/TRC–1 through the A-C LINE cord.

b. Mute On-Off Switch. When the CARRIER CONTROL switch is in position 1, and the MUTE ON-OFF switch is ON, operating the push-to-talk switch on the handset shorts the loudspeaker and the receiver unit of the handset to ground through the antenna changeover relay. The MUTE ON-OFF switch is in the D, E, and H models only.

c. Receiver Output Binding Posts. These posts are used in four-wire radio remote control to connect the receiver high-fidelity output to LINE 2 of Remote Control Unit AN/TRA–2 (pars. 180 through 184).

d. Line Fuse. The LINE FUSE protects the various components of the receiver from damage that might be caused by shorts and excessive overload.

e. Push for Line Check Switch. This switch is used for checking proper operating line voltage. The METER SWITCH should be rotated to position 6 and the PUSH FOR LINE CHECK switch operated.

f. Squelch On-Off Switch. This switch is used to remove the squelch relay from the circuit when squelch operation is not desired.

g. Squelch Adjust Control. The level of sensitivity at which the squelch relay operates may be varied by adjusting this control. This adjustment is used together with the SQUELCH ON-OFF switch when squelch operation is desired.

h. Line On-Off Switch. In the ON position, the power line switch connects the receiver to the a-c power source.

i. Power on Lamp. When power is applied, the green POWER ON pilot lamp will light.

j. Meter Switch. The six-position meter selector switch, S106, connects meter M101 into the various receiver circuits to facilitate tuning and operation of the unit.

k. Carrier on Lamp. The CARRIER ON pilot lamp indicates to the operator that the remote transmitting station is on the air even though no modulation may be present on the carrier. The SQUELCH switch should be ON and the squelch ADJUST control properly set (par. 131*o*).

l. Multichannel Single Channel Switch. Low-pass filter T117 may be cut in or out of the high-fidelity circuit by means of the MULTICHANNEL SINGLE CHANNEL switch. When this switch is in the SINGLE CHANNEL position, low-pass filter T117 is inserted in the audio output line and no frequencies above 3,000 cycles will apear at the RECEIVER OUTPUT terminals or at terminals A and C of Plug P103.

m. Audio Gain Control. The AUDIO GAIN control is a screw driver adjusted potentiometer which sets the audio output level of the high-fidelity circuit.

n. Speaker On-Off Switch. This switch is placed in the ON position to put the loudspeaker in operation.

o. Speaker Volume Control. The SPEAKER VOLUME control is a potentiometer which adjusts the low-fidelity audio level to the monitoring loudspeaker and the receiver unit of the handset.

p. Control Cable Receptacle. This receptacle engages the plug of Cord CX–8/TRC–1 or CX–104/TRC–1, which contains the audio and control interconnections between the receiver and transmitter.

q. Ant. Input Receptacle. This receptacle engages the plug of Cord CD–800 or CG–107/U used for connecting the antenna to the receiver or connecting the receiver antenna circuit to the transmitter.

r. Antenna Tuning Control. When communication is established, the ANTENNA TUNING control is adjusted for maximum meter reading with the METER SWITCH in position 1 or 2 (pars. 131*g* and 131*n*).

121. Amplifier Controls
(fig. 81)

a. R-F Input. The output of Radio Transmitter T–14(*)/TRC–1 is fed into the amplifier through the R-F INPUT receptacle.

b. Filament On-Off Switch. When the filament ON-OFF switch is in the ON position, it completes the primary power circuits to the filament transformer in the amplifier and the filament supplies in Power Supply PP–13(*)/TRA–1.

c. Filament Pilot Lamp. When the filament switch is ON, the FILAMENT (green) pilot lamp should light.

d. High Voltage Cable and Power Cable Receptacles. All power for operation of the

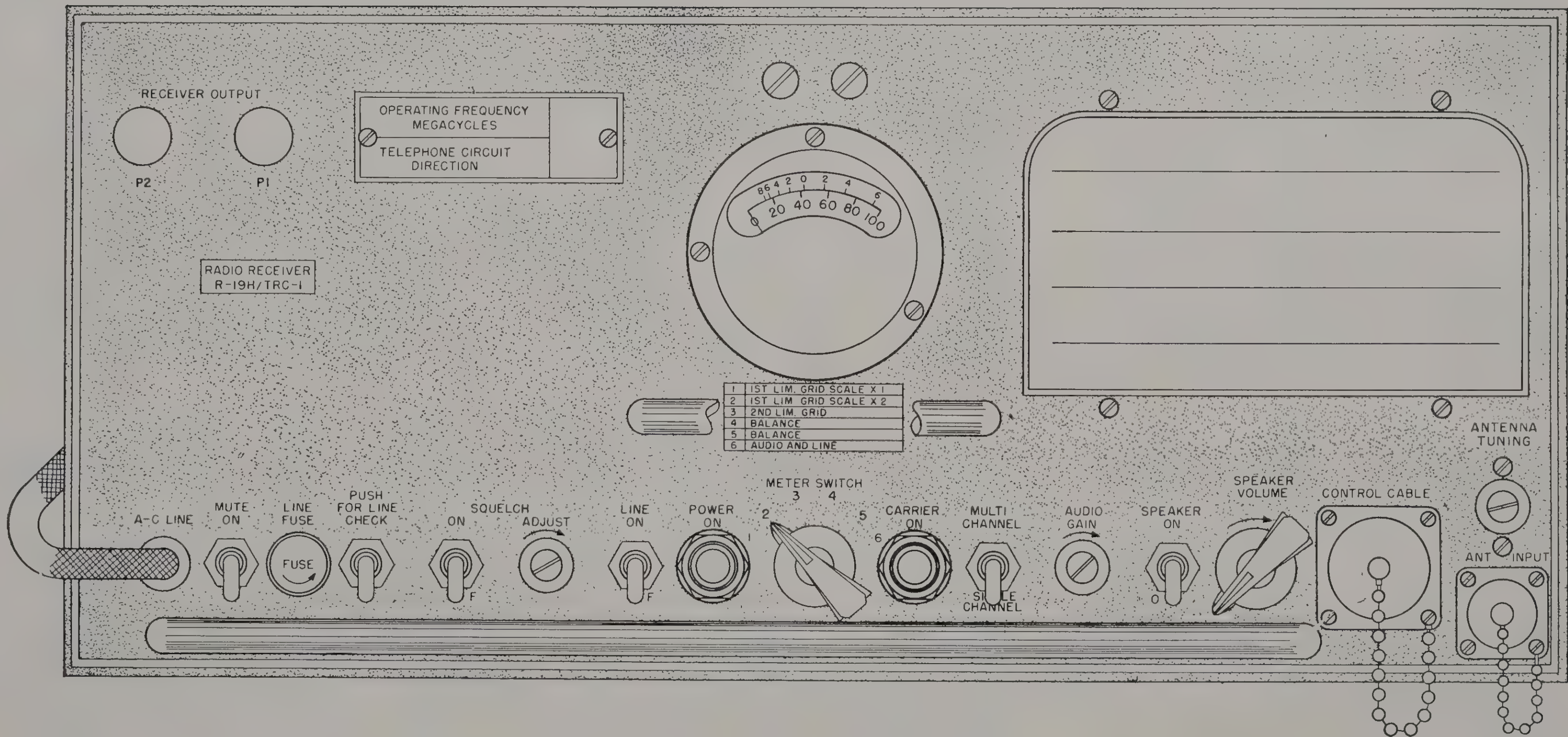


Figure 80. Receiver R-19H/TRC-1, front panel.

amplifier is derived from Power Supply PP–13(*)/TRA–1 through the power cord and the POWER CABLE receptacle, and the h-v cable and HIGH VOLTAGE CABLE receptacle.

e. PLATE TUNING CONTROL. Split-stator capacitor C208, which resonates the plate circuit, can be adjusted (pars. 132*i* through *k*) from the front panel (PLATE TUNING control) through a worm-gear drive.

f. GRID TUNING CONTROL. Grid coil L202 is tuned to resonance by split-stator capacitor C201 which can be adjusted (pars. 132*d* through 132*l*(1)) from the front panel (GRID TUNING control) through a worm-gear drive.

selector switch S201 connects meter M201 into the various grid and plate circuits of the amplifier to facilitate tuning (pars. 132*d* through *i*) and operation.

j. TUNE OPERATE SWITCH. This switch provides low plate and screen voltages when in the TUNE position. When the switch is in the OPERATE position, carrier power of approximately 200 watts is available.

k. ANTENNA LOADING CONTROL. The inductive reactance of coil L204 and the associated wiring is tuned out by capacitor C209. This capacitor is adjusted from the front panel (ANTENNA LOADING) and acts as the p-a stage loading adjustment.

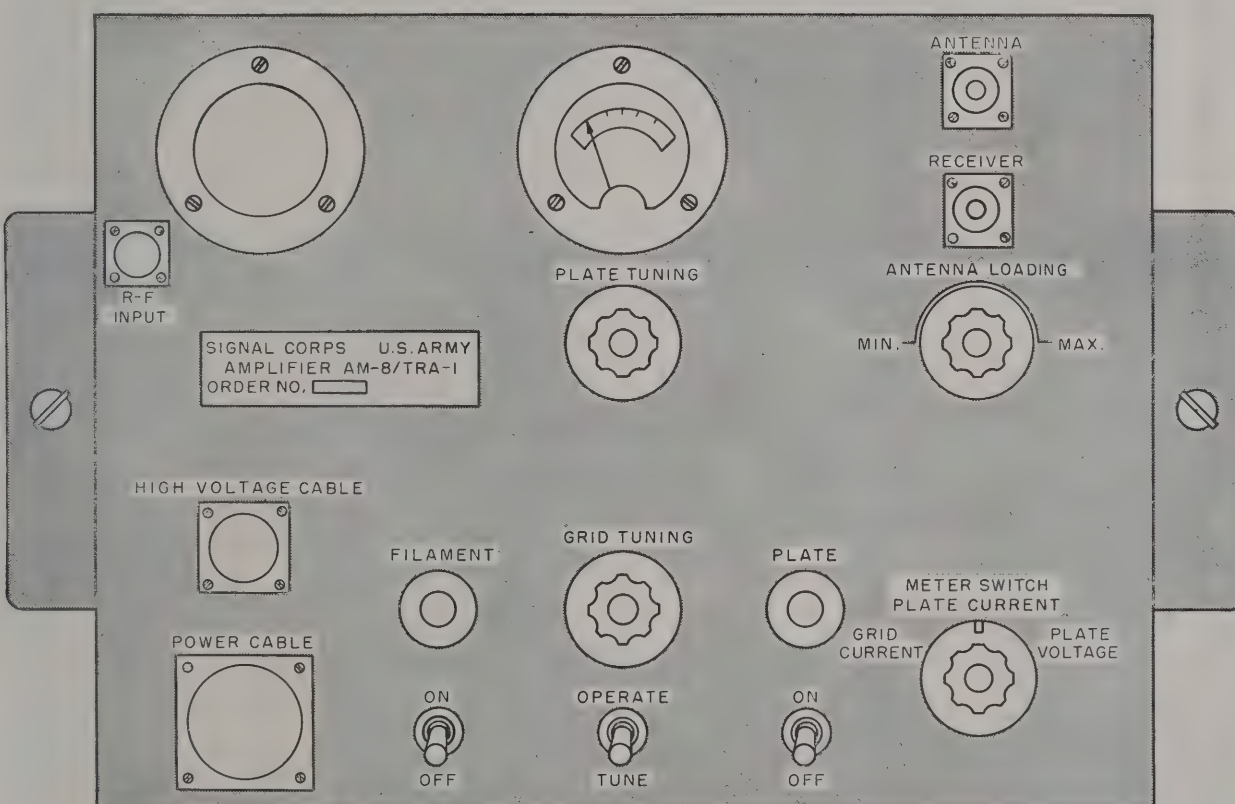


Figure 81. Amplifier AM–8/TRA–1, front panel.

g. PLATE POWER ON-OFF SWITCH. When this switch is in the ON position, the h-v power supply in Power Supply PP–13(*)/TRA–1 is energized.

h. PLATE PILOT LAMP. When the plate switch is ON, the PLATE (red) pilot lamp should light.

i. METER SWITCH. Three-position meter

l. ANTENNA RECEPTACLE. The transmitting antenna is connected to this receptacle by means of Cord CD–800 or CG–107/U.

m. RECEIVER RECEPTACLE. When using a single antenna for transmitting and receiving, the amplifier RECEIVER connector and the re-

ceiver ANT. INPUT connector must be joined together by Cord CD–800 or CG–107/U.

122. Power Supply Controls
(fig. 82)

Power Supply PP–13 (*) /TRA–1 supplies the necessary operating voltages to Amplifier AM–8(*)/TRA–1. All control functions are located in the amplifier, and the power supply always must be used in conjunction with that unit. The description of the power supply fuses and outlets is given in *a* through *d* below.

a. OUTLET FUSE. The convenience outlets are protected by screw type fuse F301.

b. AMPLIFIER FUSE. Amplifier AM–8(*)/TRA–1 receives all of its primary and secondary power through Power Supply PP–31(*)/TRA–1. Fuse F302 protects the primary circuits of the amplifier.

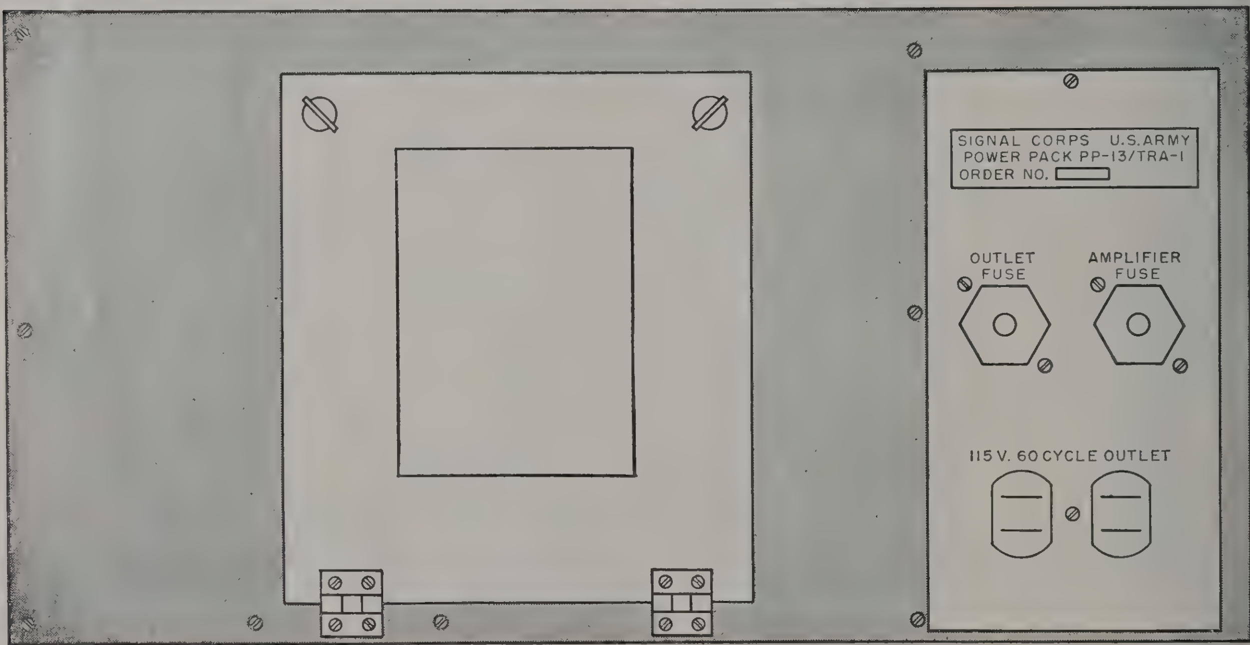


Figure 82. Power Supply PP–13/TRA–1, front panel.

c. 115 V. 60 CYCLE OUTLET. The two convenience outlets are for general utility use when 115-volt a-c power is required.

d. HIGH VOLTAGE FUSE. H-v fuse F303 is in the B— lead. It is located inside of the power supply.

123. Test Oscillator Controls
(fig. 83)

a. R-F OUTPUT RECEPTACLE. This receptacle engages the plug of the 40-inch Cord CD–800 or CG–107/U used for connecting the test oscillator to Radio Receiver R–19(*)/TRC–1.

b. TUNING CONTROL. This control is used to resonate the plate circuit of the test oscillator. The output of the oscillator may be decreased by detuning this control.

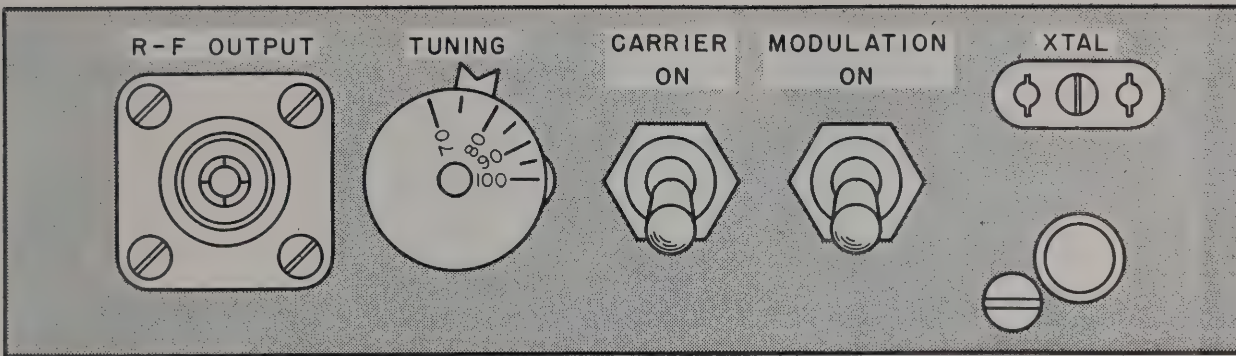
c. CARRIER ON SWITCH. This switch controls the plate and screen voltages to all tubes in the test oscillator.

d. MODULATION ON SWITCH. This switch controls the plate and screen supply to the audio oscillator. It is possible to get an unmodulated r-f signal by throwing this switch to the off position.

e. XTAL SOCKET. When tuning the receiver, select a transmitter crystal for the operating frequency that the receiver is to be set to, and place the crystal in the XTAL socket.

124. Power Unit PE–75–(*) Controls

For a complete explanation of the controls



TM 2601-65

Figure 83. Front panel of Test Oscillator TS–32(*)/TRC–1 (except C and D models).

(fig. 84) of Power Unit PE–75–(*), refer to TM 11–900.

a. Fuel Shut-Off Valve. This is located on top of the fuel filter unit; the fuel filter unit is secured to the bottom of the gasoline tank.

b. Carburetor Needle Valve. This is at the bottom of the carburetor. Open and close this as shown in B, figure 84.

c. Starter Rope and Starter Pulley. The The starter pulley is located at the outer end of the flywheel.

d. Choke Lever and Valve. These are located on the carburetor air intake.

e. Governor Adjustment Rod. This operates the throttle through a mechanical linkage.

f. Idle Adjustment Screw. Located on the upper part of the carburetor.

g. Throttle Lever Adjustment Screw. This is located next to the idle adjustment screw on the upper part of the carburetor.

h. Stop Button. This is located above the starter pulley on the flywheel cover.

125. Control Box C–21(*)/TRC–1 Controls (fig. 85)

a. Headset. This jack receives Plug PL–55 of the handset.

b. Microphone. This jack receives Plug PL–68 of the handset.

c. Circuit Direction A-B Switch. This switches the handset to either the "A" or "B" direction during communication between a relay station and another station.

d. Plugs PL-55. One of these plugs into the HEADSET jack of each transmitter.

e. Plugs PL–68. One of these plugs into the MIC. jack of each transmitter.

Section II. PRELIMINARY ADJUSTMENTS AND TUNING

Caution: Voltages dangerous to human life appear on the plate leads of the p-a tubes and the power supply circuits. Do not touch these parts with the plate voltage on.

126. Preliminary Adjustment of Transmitter

Before the transmitter can be operated, the operating frequency must be determined (pars. 134 and 143) and the transmitter must be tuned for that operating frequency. However, before the tuning procedure can be carried out, the following preliminary steps should be taken.

a. Remove the A-C LINE cord plug from the primary power receptacle (wall outlet or Junction Box JB–110).

b. Check the LINE FUSE, H. V. FUSE, and the P. A. FUSE (SEL. RECT. FUSE in the H model) which are mounted on the front panel (fig. 79).

c. Remove the transmitter from its shock-mounting rack in Case CY–17(*)/TRC–1 by turning the locking fasteners one-fourth turn counterclockwise and then pulling on the handle located in the middle of the front panel. The transmitter will slide forward and then may be slid and lifted out of the case.

d. Open the top cover of the transmitter

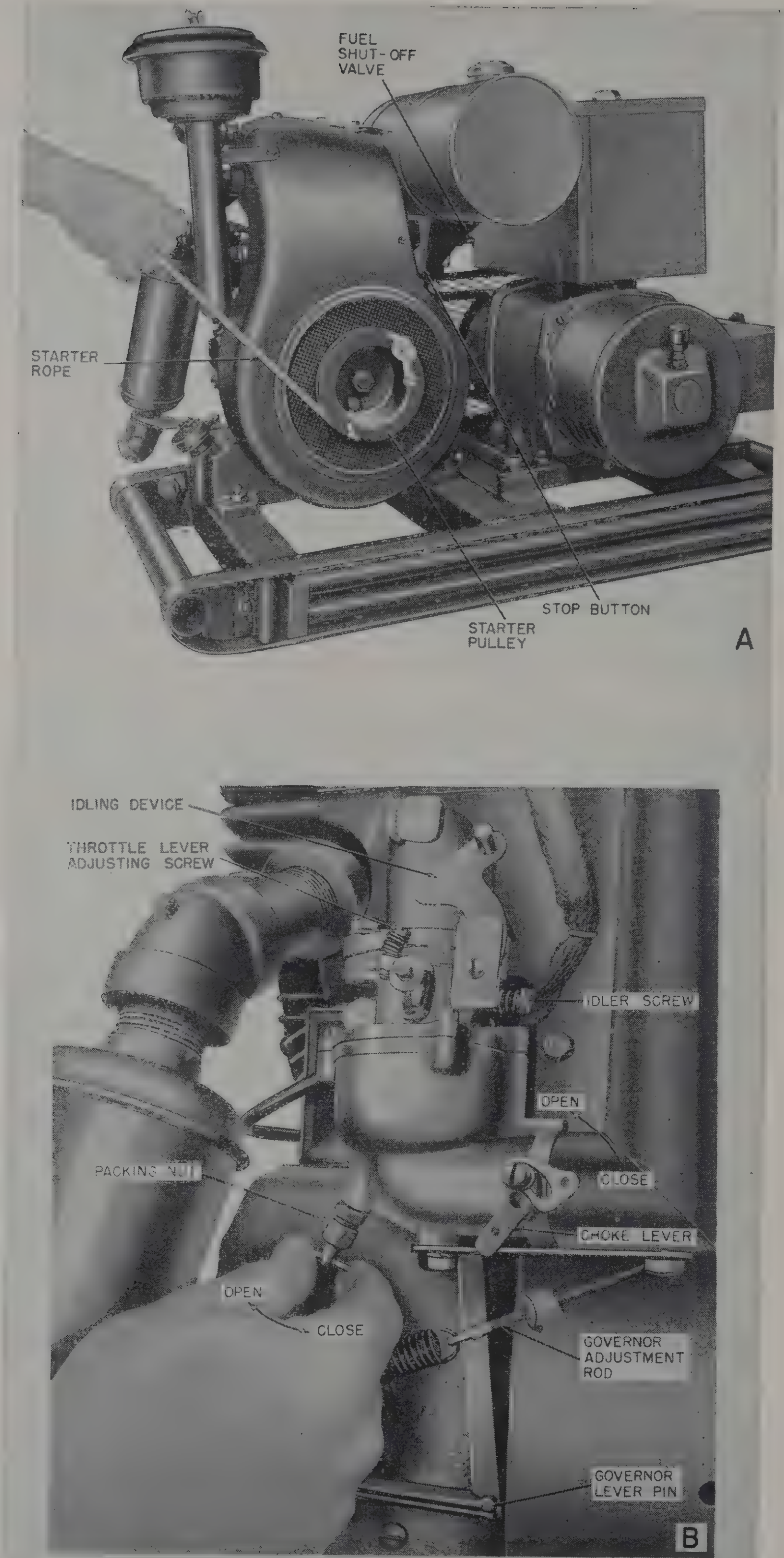


Figure 84. Control items on Power Unit PE–75–(*).

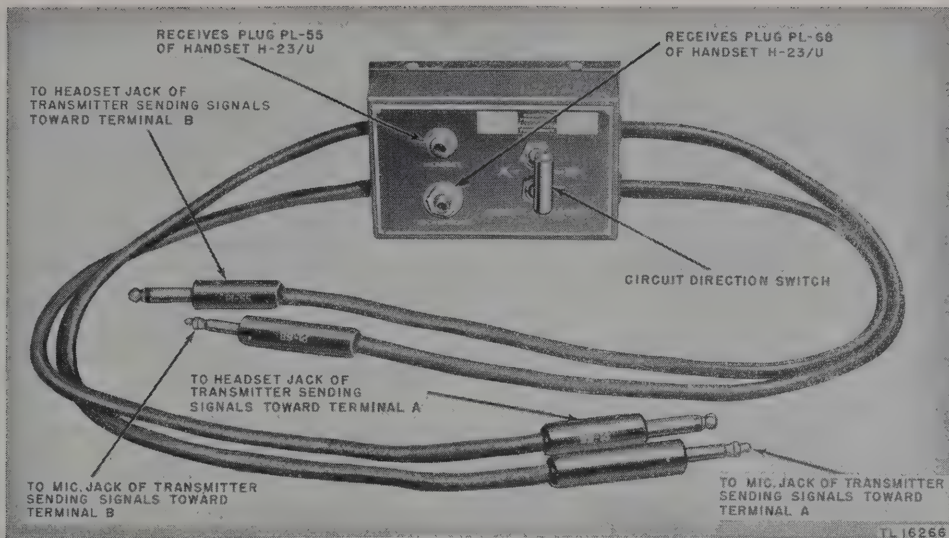


Figure 85. Connections of Control Box C–21(*)/TRC–1.

cabinet and check that all tubes are in place (fig. 86).

e. Select the proper transmitting crystal for the operating frequency desired (pars. 134 and 143) and install the crystal in the crystal oven.

f. Turn the CARRIER CONTROL switch to LOCAL CONTROL (position 1).

g. Place the POWER HIGH-LOW switch in the LOW position.

h. Insert Plugs PL–55 and PL–68 of the handset into the HEADSET and MICROPHONE jacks, respectively, on the front panel. The handset switch thus may be used to control the application of plate power while the transmitter is being tuned.

i. Insert Indicator Subassembly MX–970/U, the antenna dummy load socket (fig. 22), into the ANTENNA connector and tighten. Then screw a 50-watt, 115-volt bulb into the dummy load socket.

j. Replace the A-C LINE cord plug in the power receptacle.

127. Preliminary Adjustment of Receiver

Before the receiver can be operated, the operating frequency must be determined (pars. 134 and 143) and the receiver carefully tuned for that frequency. However, before tuning the receiver, carry out the following preliminary steps:

a. Remove the A-C LINE cord plug from the primary power receptacle.

b. Remove the receiver from its shock-mounting rack in Case CY–18(*)/TRC–1 by turning the locking fasteners one-fourth turn counterclockwise and pulling on the handle located in the middle of the front panel. The receiver will slide forward and then may be slid and lifted out of the carrying case.

c. Open the top cover of the receiver cabinet and check that all tubes are in place (fig. 87).

d. Check that the LINE FUSE, located on the front panel, is in the holder and in good condition.

e. Select the proper receiving crystal for the operating frequency desired (pars. 134 and 143) and place it in crystal socket YS101.

f. Select a transmitter crystal for the same operating frequency and place it in the crystal socket of Test Oscillator TS–32(*)/TRC–1. The test oscillator is necessary for tuning the receiver.

g. Insert the plug of the test oscillator power cord into socket P106. P106 is located inside of the receiver. The filament and plate circuits of the test oscillator will be energized when the receiver LINE ON-OFF switch is turned ON. Set the test oscillator TUNING control to the operating frequency to be received.

h. Replace the A-C LINE cord in the primary power receptacle.

128. Preliminary Adjustment of Amplifier AM–8(*)/TRA–1

If the circuit requires more power output than the 50-watts of the transmitter, Amplifier

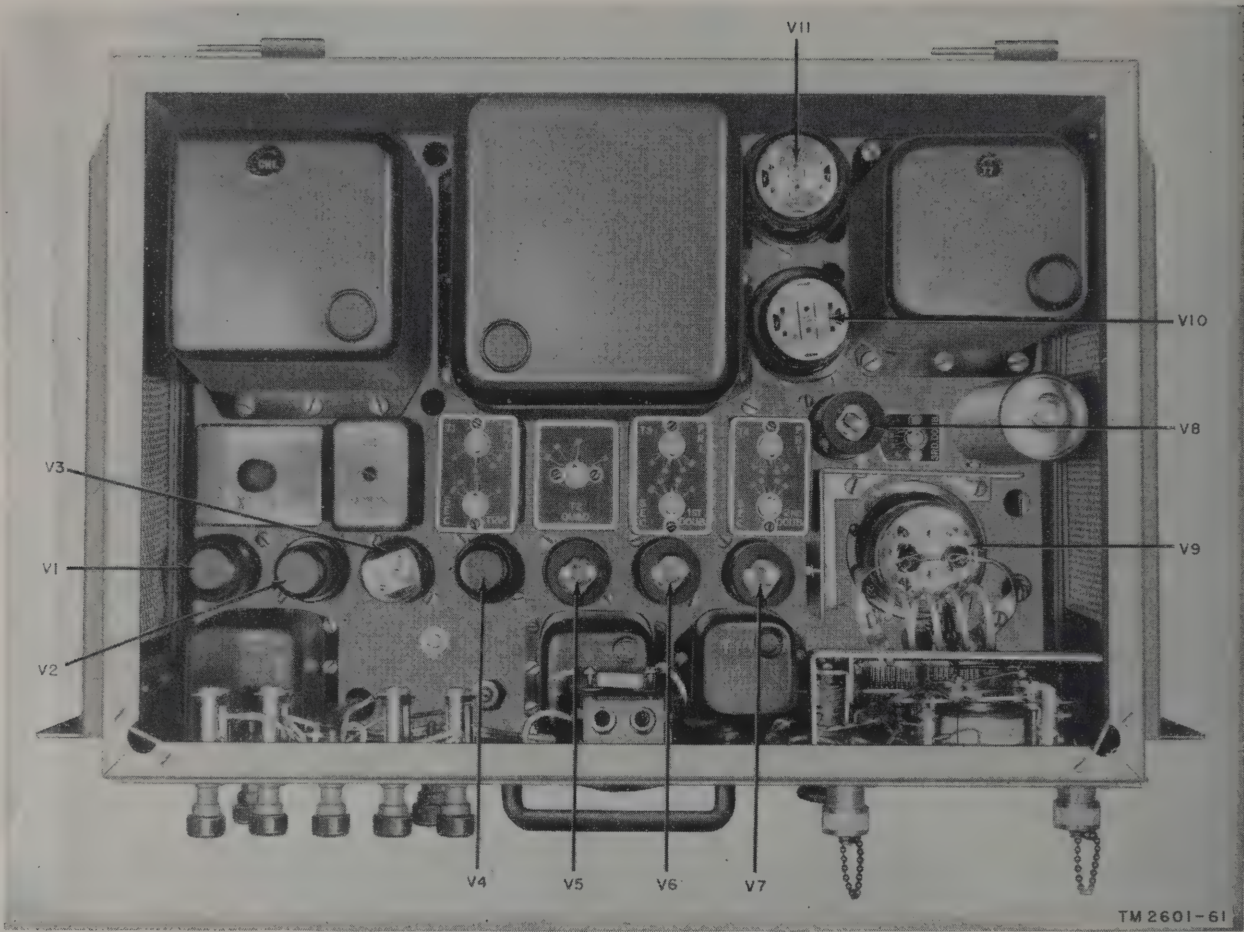


Figure 86. Tube placement in Radio Transmitter T–14H/TRC–1.

AM–8(*)/TRA–1 will be necessary. Make the following preliminary checks:

a. Disconnect any power cords attached to Power Supply PP–13(*)/TRA–1 (make sure that the power supply is turned off before removing the power cords).

b. Remove the amplifier from its shock-mounting rack in Case CY–15(*)/TRA–1 by turning the locking fasteners one-fourth turn counterclockwise and pulling on the handles on the front panel. The amplifier will slide forward and then may be slid and lifted out of the carrying case.

c. Open the top cover of the amplifier cabinet and check that all tubes are in place (fig. 37).

d. Set the TUNE OPERATE switch to TUNE.

e. Turn the ANTENNA LOADING control to its maximum counterclockwise position.

f. Reconnect all power cords to the power supply.

129. Preliminary Adjustment of Power Supply PP–13(*)/TRA–1

Power Supply PP–13(*)/TRA–1 is used to supply power to Amplifier AM–8(*)/TRA–1. Since all control functions for the power supply are located in the amplifier, it always must be used with the amplifier.

a. Remove the power input cord from the primary power receptacle.

b. Open the front cover door by turning the locking fasteners one-fourth turn counterclockwise and check that all tubes are in place (fig. 38). The initial tube supply, in some procurements, is boxed in the left compartment of Case CY–16(*)/TRA–1.

c. Check the AMPLIFIER FUSE on the

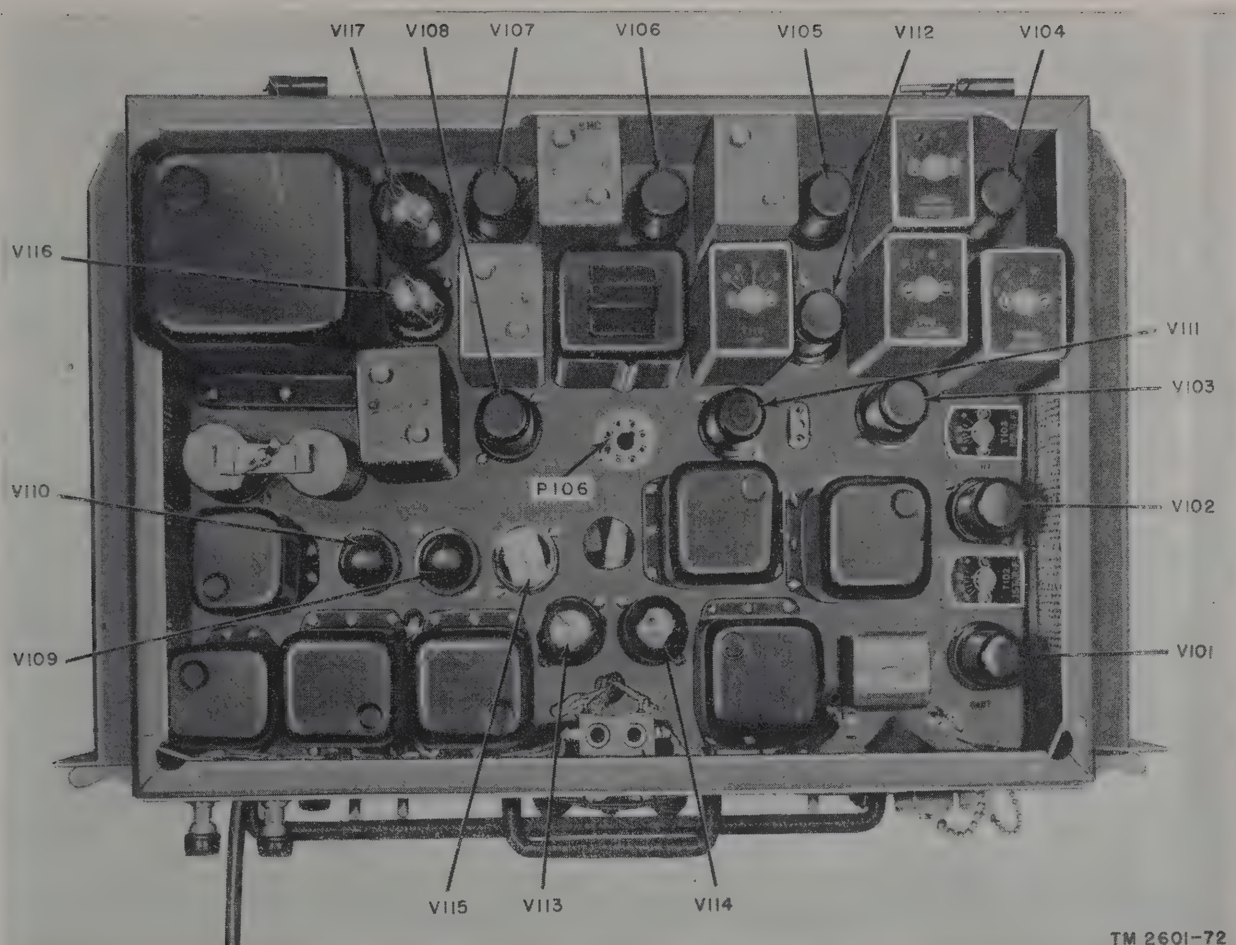


Figure 87. Radio Receiver R–19H/TRC–1, tube placement.

front panel (fig. 82). If either of the two convenience outlets on the front panel of the power supply are to be used, check the OUTLET FUSE. Check h-v fuse F303 inside the panel door (fig. 172).

d. Replace the power input cord into a live power receptacle.

130. Tuning the Transmitter

All tuning controls that must be adjusted each time the transmitter is tuned to a channel other than that for which it was preset are marked to indicate their approximate settings (fig. 88). *During all tuning operations except the ANTENNA LOADING adjustment (v through x below), the POWER HIGH-LOW switch must be in the LOW position.*

a. With a small screw driver, set the tuning controls on the transformers marked T1, T2, T3, T4, T5, and, in the D and E models only, T11 for the desired operating frequency. A small indicator dial is available for each capacitor that tunes a transformer winding over its frequency range. These dials are marked at every 10-mc point between 70 and 100 mc. To approximately adjust any of these circuits to a given frequency of operation, rotate the control until the proper dial marking is opposite the index pointer.

b. Check that the 115-volt a-c primary power is connected to the transmitter by means of the A-C LINE power cord.

c. Throw the LINE ON-OFF switch to ON. The green FILAMENT ON pilot lamp should light.

d. Wait several minutes for the tubes to become thoroughly warm.

e. Check that the CARRIER CONTROL

switch is in the LOCAL CONTROL position (1).

f. Place the METER SWITCH in position 1.

g. Apply plate power to the transmitter by operating the handset switch.

h. Tune the primary and secondary of transformer T11 in the D and E models; tune the primary and secondary of T1 in all models; a maximum reading of more than .2 ma should show on the meter. The unlettered, A, B, and C models may have maximum readings between .1 and .2 ma. Release the handset switch.

i. Place the METER SWITCH in position 2 and apply plate power by pressing the handset switch.

k. Place the METER SWITCH in position 3 and press the handset switch.

l. Tune T3 for maximum; this should be about .5 ma. The H model has both primary and secondary adjustments on this transformer. Release the handset switch.

m. Place the METER SWITCH in position 4 and operate the handset switch.

n. Tune T4 for a maximum reading of about 1.3 ma. The H model has both primary and secondary adjustments. Release the handset switch.

o. Place the METER SWITCH in position 5 and operate the handset switch.

p. Tune T5 for a maximum reading of about

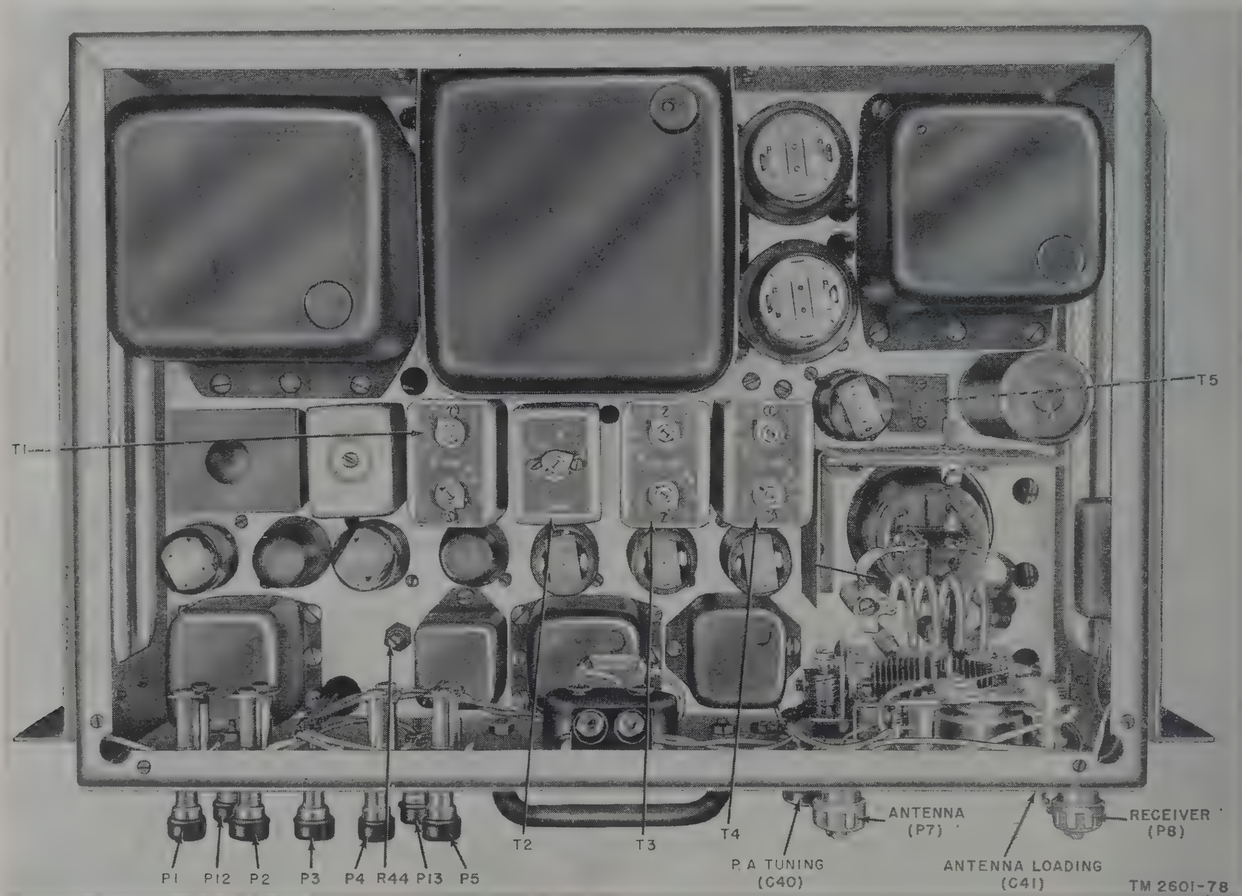


Figure 88. Tuning adjustments in Radio Transmitter T–14H/TRC–1,

j. Tune transformer T2 for a maximum reading. This should be between .4 and .7 ma. Readjust the transformers tuned in *h* above for maximum. Readjust T2 for maximum. Release the handset switch.

1.2 on the meter. This is actually about 6 ma of p-a grid current when the correct multiplier (5) is used.

q. Leaving the METER SWITCH in position 5, retune T11, T1, T2, T3, T4, and T5 very

carefully until maximum reading is obtained. The movement of any tuning control should be very slight. *This careful retuning is essential. Its accuracy materially reduces the interference caused by spurious radiations in the output of the transmitter.* Release the handset switch.

r. Turn the ANTENNA LOADING control to its maximum counterclockwise position. This is the minimum capacitance position of capacitor C41 and will feed the lowest amount of r-f power to the antenna (or the amplifier).

s. Place the METER SWITCH in position 6 and press the handset switch.

t. Tune the P. A. TUNING control on the front panel for a minimum meter reading. Release the handset switch.

u. Switch the POWER HIGH-LOW switch to HIGH. Press the handset switch. The meter reading should be approximately .4; this is actually about 40 ma of p-a cathode current when the correct multiplier (100) is used. Release the handset switch. If Amplifier AM–8(*)/TRA–1 is to be used, continue with the tuning procedures described in paragraph 132. If Amplifier AM–8(*)/TRA–1 will not be used, continue with *v* through *y* below.

v. Unscrew Indicator Subassembly MX–970/U from the ANTENNA connector. Connect the antenna, through Cord CD–800 or CG–107/U, to the ANTENNA connector.

w. Rotate the ANTENNA LOADING control clockwise until the p-a cathode current reaches 165 ma (1.65 on the meter). In the unlettered, A, B, and C models it is necessary to exercise extreme caution to keep the p-a cathode current from rising excessively during tuning in order to prevent damage to the final amplifier tube. The D, E, and H models have fixed bias for final p-a tube protection and it is not necessary to exercise the same care in preventing excessive cathode current while tuning.

x. Readjust the P. A. TUNING control for minimum cathode current. Adjust the ANTENNA LOADING control again for 165-ma cathode current. Repeat this procedure until the loaded p-a cathode current is 165 ma at resonance and no further dip is obtained by rotating the P. A. TUNING control.

y. The transmitter now is fully tuned; replace it in Case CY–17(*)/TRC–1. When the transmitter is used with Amplifier AM–8(*)/TRA–1, refer to paragraph 132 for the proper antenna and output stage tuning procedures.

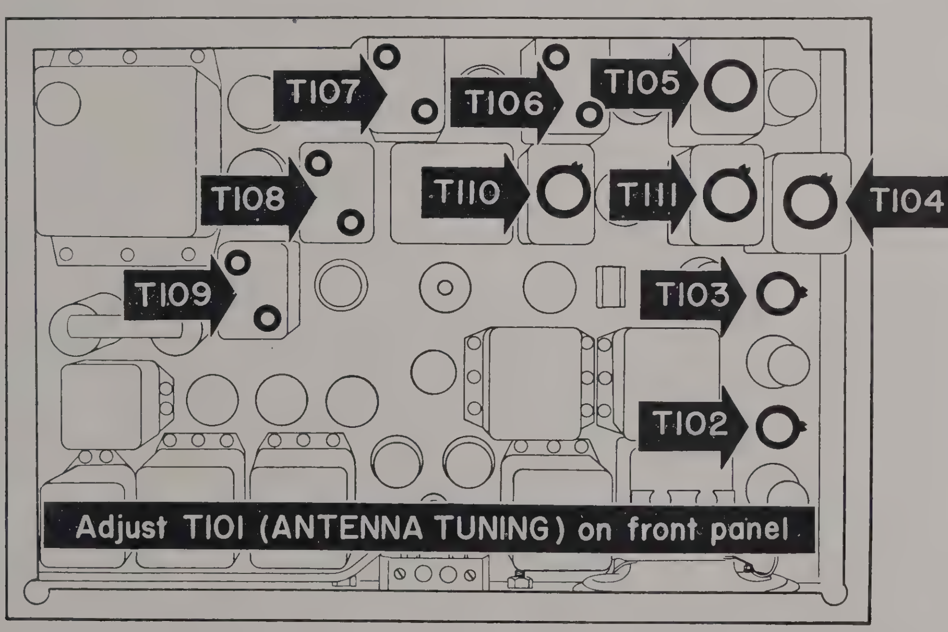


Figure 89. Tuning adjustments on Radio Receiver R–19(*)/TRC–1.

131. Tuning the Receiver

a. Check that the A-C LINE power cord is connected to 115-volts ac. Throw the LINE ON-OFF switch to ON. Allow the receiver to warm up for several minutes.

b. All tuning controls that must be adjusted each time the receiver is tuned to a channel other than that for which it was preset are marked to indicate their approximate settings (fig. 89). Set the tuning controls on the transformers marked T102, T103, T104, T105, T110, and T111 for the desired frequency.

c. Each capacitor that must be adjusted to tune a transformer winding has a small indicator dial. These dials are marked at every 5-mc point between 70 and 100 mc. To adjust any of these circuits to their proper frequency (approximately), rotate the control until the proper dial marking is opposite the index pointer. *Do not adjust T106, T107, T108, and T109 until the tuning procedure has been completed through e below.*

d. With the tuning adjustments set to their approximate position, throw the SQUELCH ON-OFF switch to OFF and rotate the SPEAKER VOLUME control for maximum volume. A loud rushing noise should be heard in the loudspeaker. If this noise is not heard, check that all vacuum tubes are warm and securely seated in their sockets.

e. Connect the R-F OUTPUT of Test Oscillator TS–32(*)/TRC–1 to the ANT. INPUT connector on the radio receiver by means of the 40-inch length of Cord CD–800 or CG–107/U.

f. Place the METER SWITCH in position 1 (1ST LIM. GRID). Observe the meter reading and throw the CARRIER ON switch of the test oscillator to ON. If the tuning controls have all been preset carefully to the operating frequency, as marked on their dials, a slight deviation of the meter will be observed. If no deviation is observed on the meter when the test oscillator carrier is turned on, change the METER SWITCH to position 3 (2ND LIM. GRID) and throw the test oscillator CARRIER ON switch off and ON. Since one more stage of amplification contributes to the second limiter grid current reading, the meter should show a deflection even if the receiver is considerably detuned.

g. Adjust the tuning controls of T110, T111, T105, T104, T103, T102, and T101 (ANTENNA TUNING), in the order named, for maximum meter readings. As soon as it is possible to get a meter reading with the METER SWITCH in position 1, keep the switch in this position for the rest of this portion of the tuning. If, with the METER SWITCH in position 1, the meter reads beyond full scale during the tuning procedure, the METER SWITCH should be moved to position 2. This will give a meter-scale reading approximately one-half as great.

h. With the METER SWITCH in position 1, decrease the output of the test oscillator by moving the TUNING control until only a slight meter reading (about 10 on the meter scale) is obtained. Carefully readjust the tuning controls for maximum meter reading in the following order: T101, T102, T103, T110, T111, T104, T105, T106, and T107.

i. Place the METER SWITCH in position 3. Adjust the controls on T108 for maximum reading on the meter.

j. Rotate the METER SWITCH to position 4 or 5 (BALANCE), whichever gives a positive reading on the meter. The meter is connected in the discriminator circuit in either switch position, but the polarity is reversed so that an upscale reading may be obtained regardless of the polarity of the discriminator output. Adjust the secondary, marked BALANCE, or discriminator transformer T109 for a reading of approximately 10 on the meter. Use the insulated alinement tool supplied with the equipment for this adjustment. Adjust the primary of T109 to give a maximum meter reading. Then readjust the secondary (BALANCE) of T109 for zero reading on the meter. If properly adjusted, the discriminator output will read 0 in both positions 4 and 5 of the METER SWITCH.

k. During the tuning procedure it will be noticed that as the receiver is brought into alinement, the signal from the test oscillator will suppress the rushing noise whenever the CARRIER ON switch is ON. At the same time an identifying tone from the test oscillator modulator circuit will be heard in the loudspeaker if the MODULATION ON switch is ON.

l. Remove the test oscillator power cord and the r-f output cable from the receiver.

m. Close the receiver cabinet cover and place the receiver back in its carrying case. Fasten the locking thumbnuts.

n. Connect the coaxial antenna transmission line to the ANT. INPUT connector on the receiver front panel. As soon as communication is established with the distant station, adjust the ANTENNA TUNING control for maximum meter reading with the METER SWITCH in position 1 or 2.

o. To adjust the squelch and carrier-operated relay circuit, throw the SQUELCH ON-OFF switch to ON and rotate the SQUELCH ADJUST control all the way to the right (clockwise). *This adjustment must be made with no signal being received.* Under these conditions, the characteristic rushing noise may be heard in the loudspeaker and the red CARRIER ON pilot may light if the antenna is in a noisy location. Rotate the SQUELCH ADJUST control back to the left (counterclockwise) until the noise ceases and the CARRIER ON pilot light goes out.

p. The procedure for making the AUDIO GAIN adjustment depends on the type of service for which the radio circuit is to be used. This adjustment is not normally made until a communication system is set up. For single-channel communication, it is not necessary to measure the audio levels accurately. Multi-channel operation requires that the audio level in each channel be held within certain limits and thus necessitates a system line-up to establish and correct operating audio levels. Maintain the operating line voltage within the range of 113 to 117 volts at all times to avoid excessive changes in audio levels.

(1) AUDIO GAIN adjustments on the unlettered through E models differs from that of the H model. If a level adjustment is made at any time when the transmitter input circuit or spiral-four cable is not connected to the receiver output, then a 500-ohm resistor must be connected across the output circuit when reading audio levels on the receiver meter.

(2) In the H model of the transmitter, a position is provided on the METER SWITCH to permit the use of the meter, in conjunction with the second triode section of tube V3, as a vacuum-tube voltmeter. Thus, position 7 (MODULATION LEVEL) may be used for checking the audio modulation level at the output of the audio amplifier section of tube V1.

132. Tuning of Amplifier Equipment AN/TRA–1

When Amplifier AM–8(*)/TRA–1 and Power Supply PP–13(*)/TRA–1 are used in conjunction with Radio Transmitter T–14(*)/TRC–1, the output of the transmitter is used to drive the amplifier instead of going directly into the antenna system. The tuning procedure for the transmitter in this case is as described in paragraphs 130 through 130*u*. The following procedure should be used in place of paragraphs 130*v* through 130*y* when the amplifier equipment is used.

a. Connect the cables from the power supply to the POWER CABLE and HIGH VOLTAGE CABLE connectors on the amplifier. Connect the power cord from the power supply to the 115-volt a-c source.

b. Throw the filament ON-OFF switch to ON; the green FILAMENT pilot should light. This will energize the grid bias supply and all filaments. The plate power ON-OFF switch and the red PLATE power pilot should stay off.

c. Connect the ANTENNA output receptacle of the transmitter to the R-F INPUT of the amplifier by means of the 40-inch transmission line Cord CD–800 or CG–107/U. Connect the antenna transmission line Cord CD–800 or CG–107/U to the ANTENNA connection on the amplifier. Turn the METER SWITCH to the PLATE CURRENT position.

d. Press the handset switch applying power to the transmitter plate circuits, and adjust the PLATE TUNING for minimum cathode current indication on the meter. (In the PLATE CURRENT position the meter actually measures plate current plus screen current minus grid current; these add up to the *cathode* current.) Then release the handset switch and set the METER SWITCH to the GRID CURRENT position. Press the handset switch and tune the amplifier GRID TUNING capacitor for maximum grid current as read by the meter on the

amplifier front panel. Only a small indication may be had at first.

e. Adjust the ANTENNA LOADING control on the transmitter slightly clockwise and retune the P. A. TUNING (on the transmitter) for minimum cathode current. Continue this procedure in small steps until the grid current in Amplifier AM–8(*)/TRA–1 is approximately 22ma. The p-a cathode current in the transmitter should be approximately 125 ma at this point. If the grid drive to the amplifier is greater than 22ma when the p-a cathode current of the transmitter is loaded to 125ma (at resonance), turn off the transmitter, amplifier, and power supply; disconnect the A-C LINE cord from Junction Box JB–110 or the power receptacle; and disconnect the POWER CABLE and the HIGH VOLTAGE CABLE of the amplifier. Loosen the coupling between transmitter plate tank coil L3 and single-turn output coil L4. Carefully move coil L4 away from coil L3 approximately one-eighth inch at a time until the proper coupling is found. *Each time this adjustment is made be sure to turn the power switches off,* and to disconnect both transmitter and amplifier from their power sources.

f. Reconnect the power cables. Throw the amplifier TUNE OPERATE switch to TUNE and plate power switch ON, applying reduced plate and screen voltage to the amplifier.

g. Retune the GRID TUNING for maximum grid current. Readjust the transmitter ANTENNA LOADING and P. A. TUNING controls for approximately 18 ma grid current in Amplifier AM–8(*)/TRA–1 with the METER SWITCH in the GRID CURRENT position.

h. Disconnect the antenna transmission line Cord CD–800 or CG–107/U from the ANTENNA connector, and set the ANTENNA LOADING control at minimum capacitance (counterclockwise).

i. With the amplifier METER SWITCH in the PLATE CURRENT position, adjust the PLATE TUNING control for minimum plate current. The meter reading should dip from about 125 ma to 75 ma as resonance is reached.

j. Connect the antenna transmission line Cord CD–800 or CG–107/U to the amplifier ANTENNA connector and increase the ANTENNA LOADING. Turn the loading control clockwise until the plate current is approximately 115 ma with the PLATE TUNING readjusted for minimum meter reading.

k. Throw the TUNE OPERATE switch to the OPERATE position and make final adjustments on the PLATE TUNING and ANTENNA LOADING controls to bring the loaded plate control to 270 ma at resonance. Make the final adjustment with the PLATE TUNING control and make sure that this control remains at the minimum meter reading position.

l. With the amplifier operating at full load, recheck the grid circuit for proper operation. When making a new installation adjust the grid current for 18 to 22 ma although any current from 12 to 20 ma is satisfactory. When initially adjusted in this manner, considerable drop in the output of Radio Transmitter T–14(*)/TRC–1, resulting in less amplifier grid excitation, can be tolerated. The proper sequence for checking the grid circuit tuning is—

(1) Tune the amplifier GRID TUNING control for maximum grid current.

(2) Adjust the P. A. TUNING on the transmitter for minimum p-a cathode current.

(3) Adjust the ANTENNA LOADING on the transmitter for 18- to 20-ma grid current on the amplifier meter.

m. Amplifier AM–8(*)/TRA–1 now is adjusted and ready for use. With the TUNE OPERATE switch in the OPERATE position, a carrier power of about 200 watts is available. With the switch in the TUNE position, the amplifier may be operated at a carrier power of approximately 50 watts. However, as this is the same output as the transmitter alone, there is no advantage in using the amplifier on TUNE, and it is not recommended because of the extra power drain on the 115-volt source.

133. Stopping Procedure

Turn plate switches off before turning off the filament or line switches. Power Unit PE–75–(*) is shut down after its electrical load is removed. To stop the power unit, press the stop button on the flywheel housing; this short circuits the magneto (TM 11–900).

134. Selection of Operating Frequencies

a. Radio Transmitter T–14(*)/TRC–1 radiates a small amount of harmonic energy at intervals equal to the crystal frequency, above and below the carrier frequency. Although the effect of these undesired radiations is limited to short distances from the transmitter, their presence must be carefully considered when allocating frequencies for use with Radio Relay Set AN/TRC–4(*) installations where several transmitters and receivers must be operated continuously in close proximity.

b. Interference charts (figs. 90 to 98) have been prepared to facilitate the selection of frequencies which will permit operation in close proximity without harmonic interference. The black squares indicate that interference from a

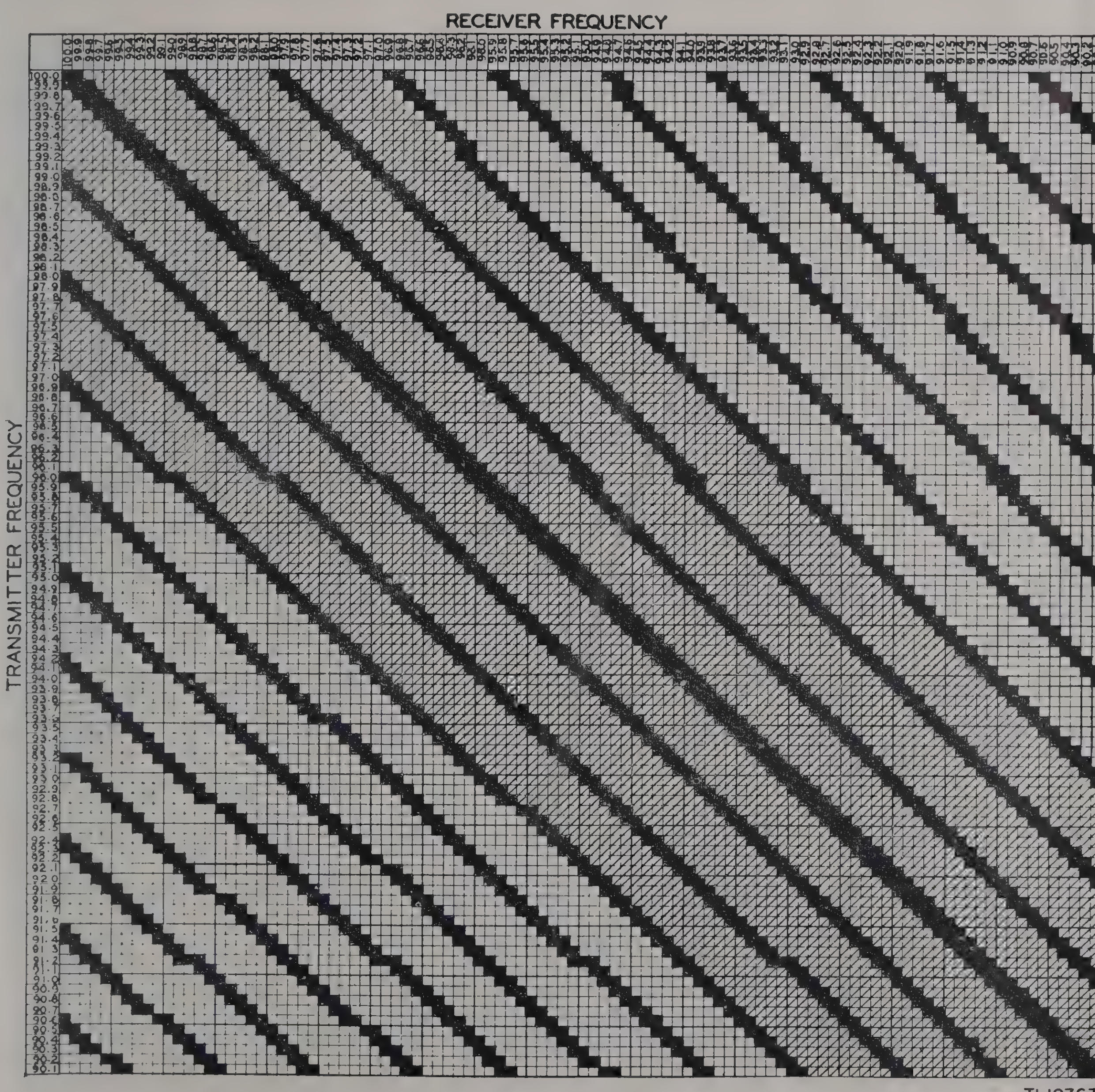


Figure 90. Interference chart; transmitter frequency 100 to 90 mc, receiver frequency 100 to 90 mc.

transmitter on the frequency shown can be expected in a receiver on the frequency shown. In the preparation of these charts, a carrier-frequency separation of less than 3mc between transmitters and receivers at the same location was considered undesirable. A separation of less than 100 kc between the desired receiving frequency and an interfering harmonic frequency from a local transmitter was considered unsatisfactory for proper operation. These charts indicate the 3-mc separation by means of hatched squares and the 100-kc separation by means of blackened squares. For example, assume that a receiver frequency of 89.8 mc is assigned. Figure 91 shows that the following transmitter frequencies in the vicinity of the receiver would cause some interference: 90.9 through 91.6 and 91.9 through 92.5 (cross-hatched squares). The following frequencies would cause considerable interference if the transmitter were located in the vicinity of the receiver: 90.7, 90.8, 91.7, 91.8, 92.6, 92.7, 92.8, 93.6, 93.7, 93.8, 94.7, 94.8, 95.7, 95.8, 96.8, 96.9, 97.9, 98.0, 99, and 99.1 (black squares).

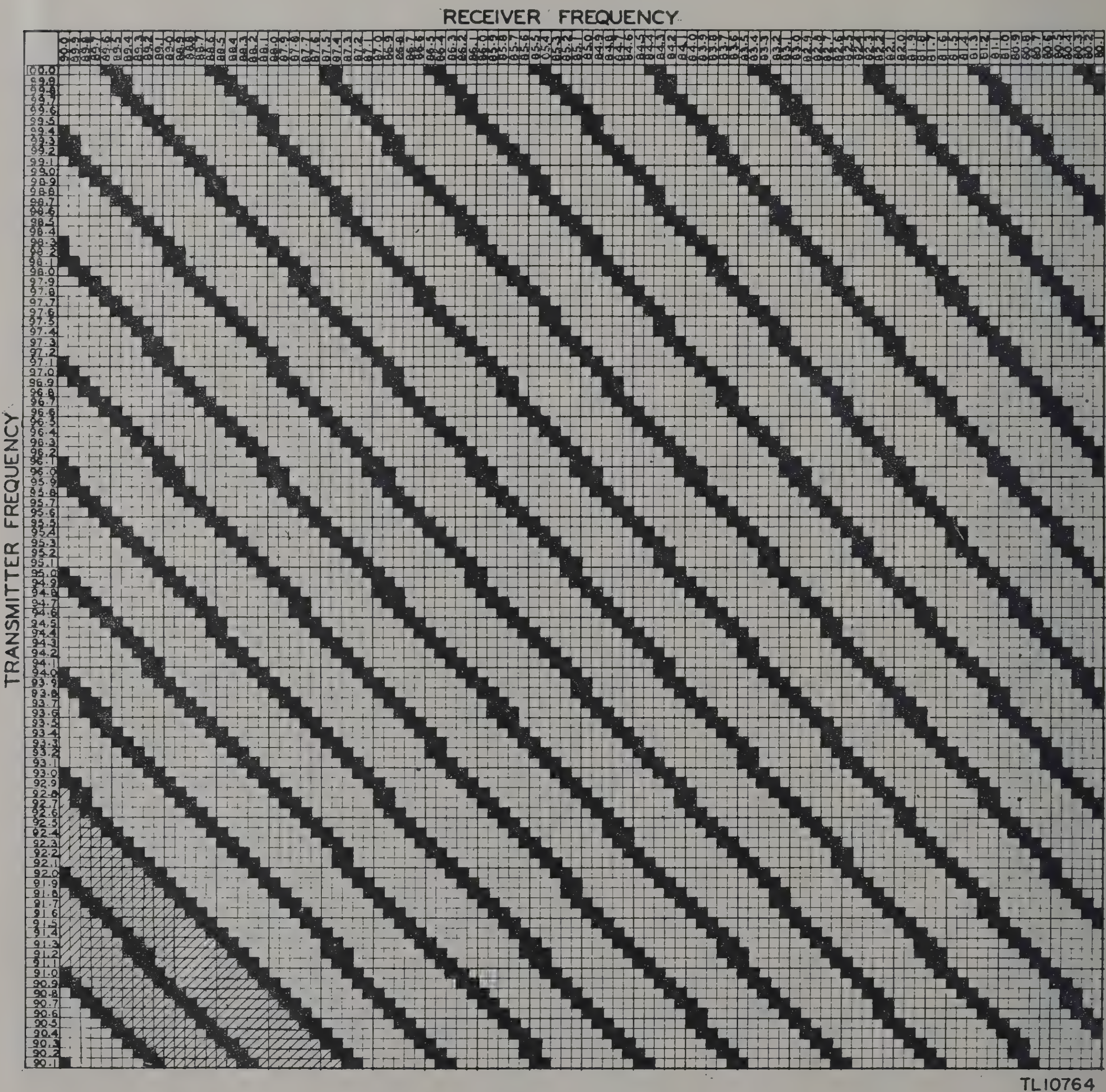


Figure 91. Interference chart; transmitter frequency 100 to 90 mc, receiver frequency 90 to 80 mc.

c. Each radio transmitter and receiver in Radio Terminal Set AN/TRC–3(*) or Radio Relay Set AN/TRC–4(*) is equipped with 16 crystals; 8 crystals in the 70- to 80-mc range and 8 crystals in the 90- to 100-mc range. These basic frequencies have been so chosen that no transmitting frequency in one range will interfere with any receiving frequency in the other range. For that reason, it is recommended that the 16 basic frequencies be used where possible in setting up the radio communication systems. At any station the radio transmitter then will be assigned an operating frequency in one frequency range and the radio receiver will be operating in the other frequency range.

d. Each Radio Terminal Set AN/TRC–3(*) also is equipped with a crystal bank consisting of 600 transmitting crystals and 300 receiving crystals in Case CY–44/TRC–3. The bank provides two transmitting crystals and one receiving crystal on each of the 300 channels within the tuning range of the equipment. The extra transmitter crystal is for use with Test Oscillator TS–32(*)/TRC–1. These channels are

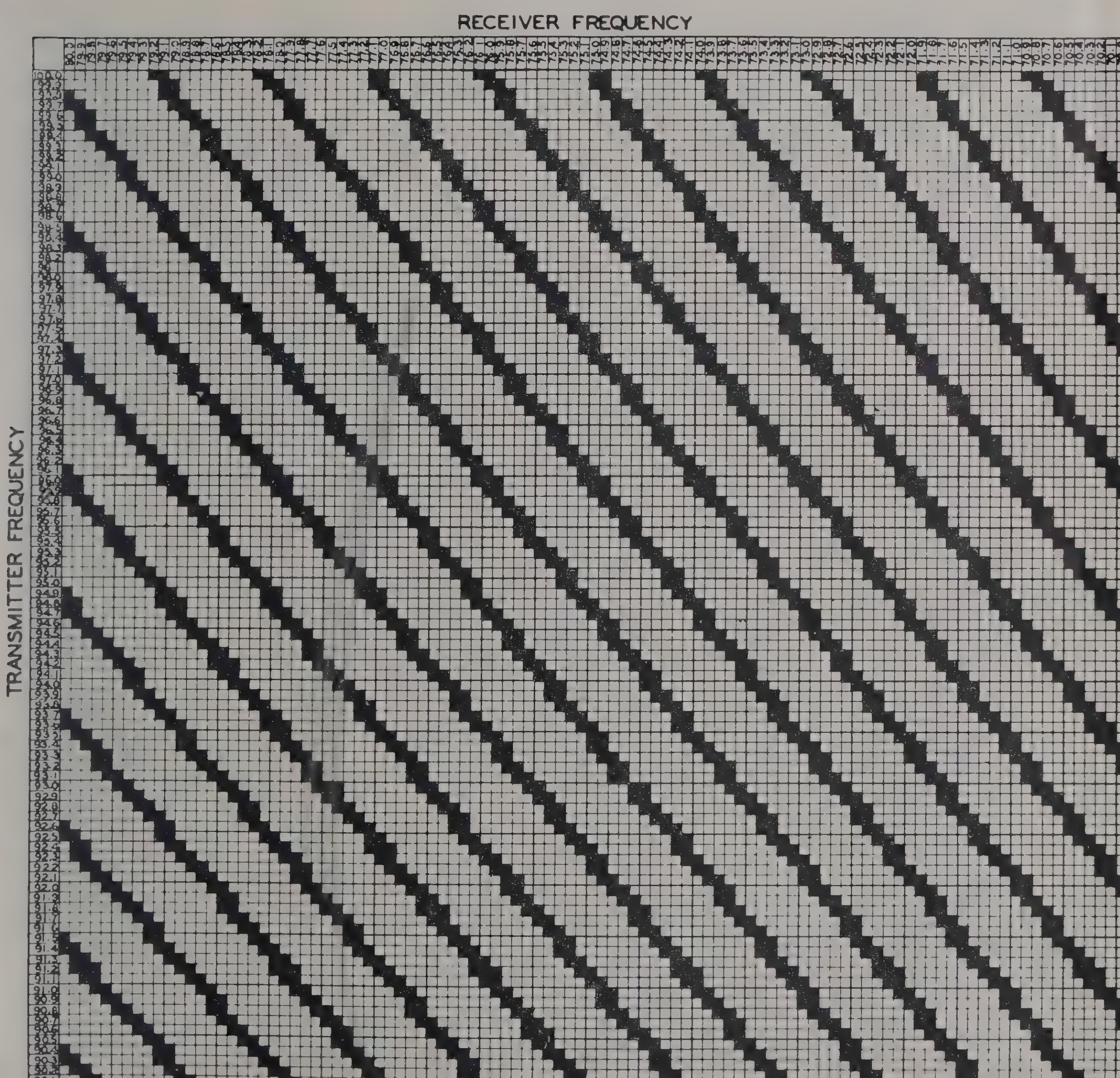


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Figure 92. Interference chart; transmitter frequency 100 to 90 mc, receiver frequency 80 to 70 mc.

numbered from 700 (70.0 mc) to 999 (99.9 mc) and are spaced at intervals of 100 kc. Channel and crystal frequencies are given in appendix II. These channels are to be used under special field conditions where it is necessary to change to other than the normal frequencies.

e. Sample frequency assignments for the radio-relay communication system using Radio Terminal Set AN/TRC–3(*) and Radio Relay Set AN/TRC–4(*) are given in table XXII. This table may be used for selecting the operating frequencies for single-channel communication systems consisting of only two terminals or of two terminals with one to three relay stations. When only two terminal stations constitute the system, the transmitter and receiver frequencies of one station may be selected from the terminal A column while the other station uses the corresponding frequencies for the transmitter and receiver of the adjacent relay station.

f. In a radio-relay communication system

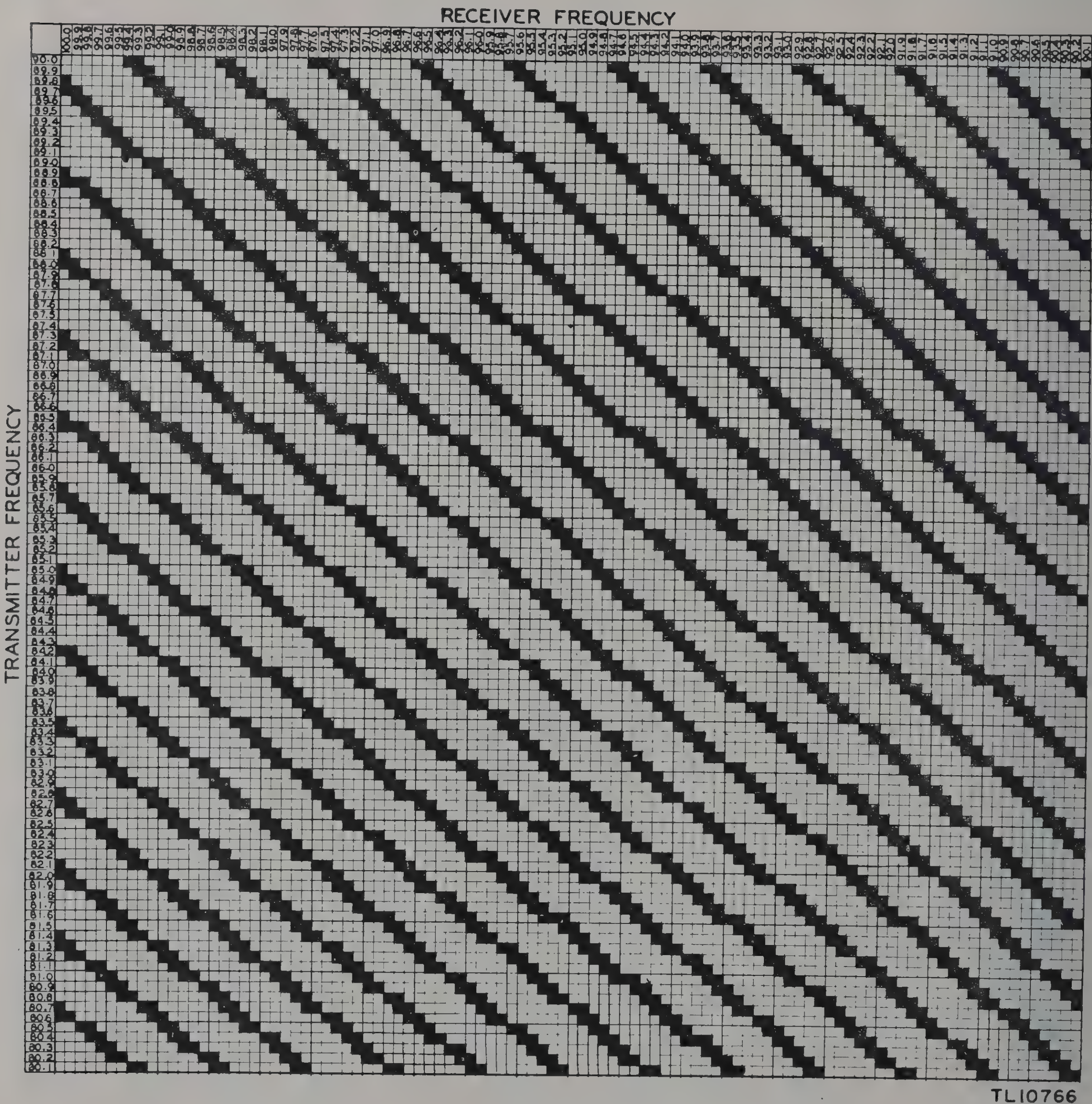

Figure 93. Interference chart; transmitter frequency 90 to 80 mc, receiver frequency 100 to 90 mc.

comprising two terminal stations and one to five relay stations spaced at 25- to 35-mile intervals, the frequency assignment problem is simple, since only two transmitters and two receivers are operated at any one relay position with directional antennas and with the receivers operating at a high signal level. However, when Radio Transmitters T–14(*)/TRC–1 and Radio Receivers R–19(*)/TRC–1 are functioning as field radio stations, and large numbers of these units are located at one position where omni- or duo-directional antennas must be used and the receivers must operate at low signal levels, the problem of preventing interference between the various transmitters and receivers is considerably more complicated.

g. In order to simplify the problem of frequency assignments at any center where as many as 3 to 20 transmitters and receivers must operate in close proximity at low signal inputs, the choice of operating frequencies should be made from tables XII through XXI. Each table

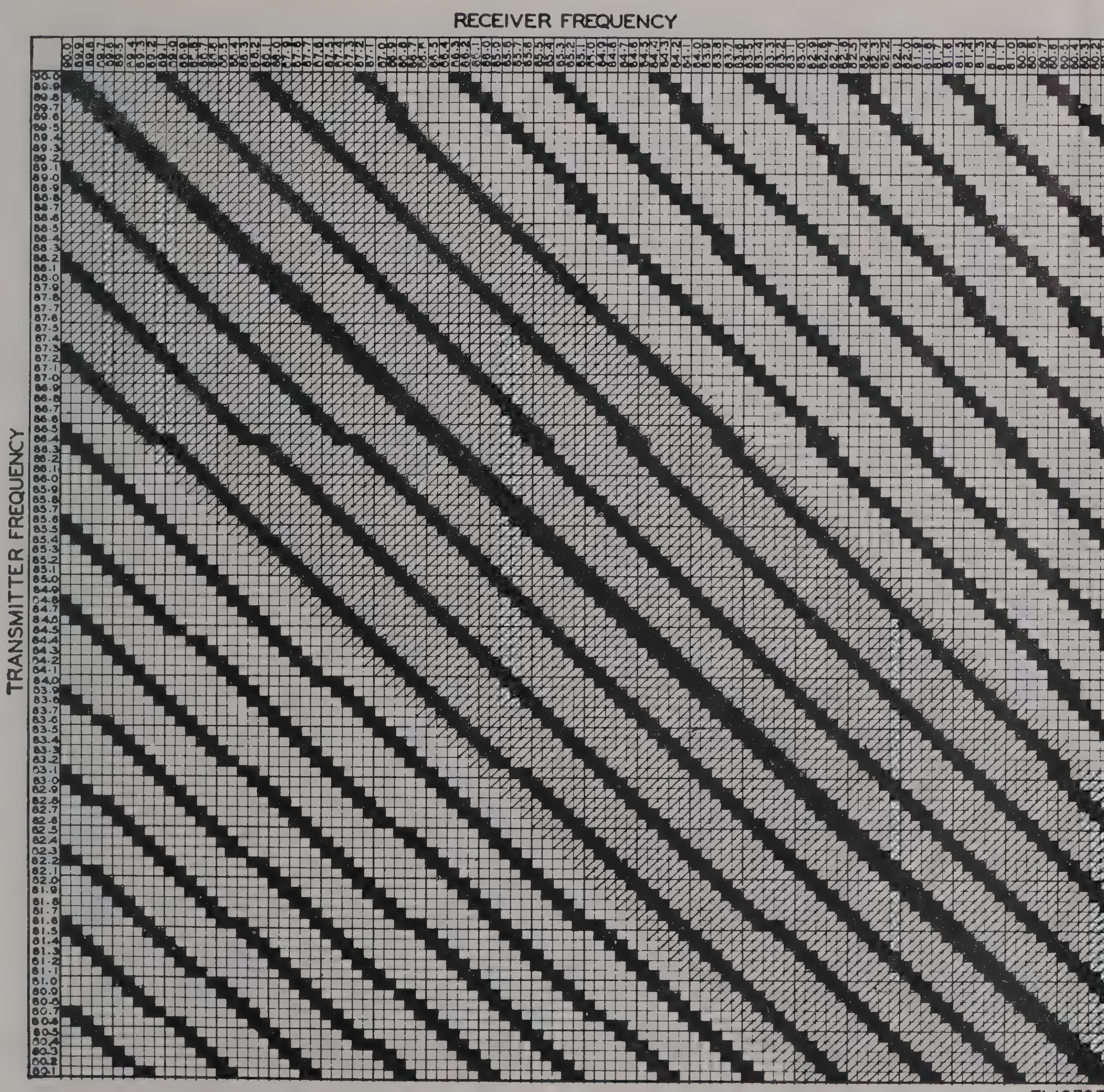

Figure 94. Interference chart; transmitter frequency 90 to 80 mc, receiver frequency 90 to 80 mc.

has a first and second choice set of frequencies. These tables are based on the following assumptions:

(1) Transmitting antenna located 500 feet from receiving antenna.

(2) Receiving antennas located in very close proximity.

(3) Nondirectional antennas. (Antenna System AS–19(*)/TRC–1 is used without the director and reflector elements.)

(4) The incoming desired signal having an intensity as low as 3 microvolts per meter.

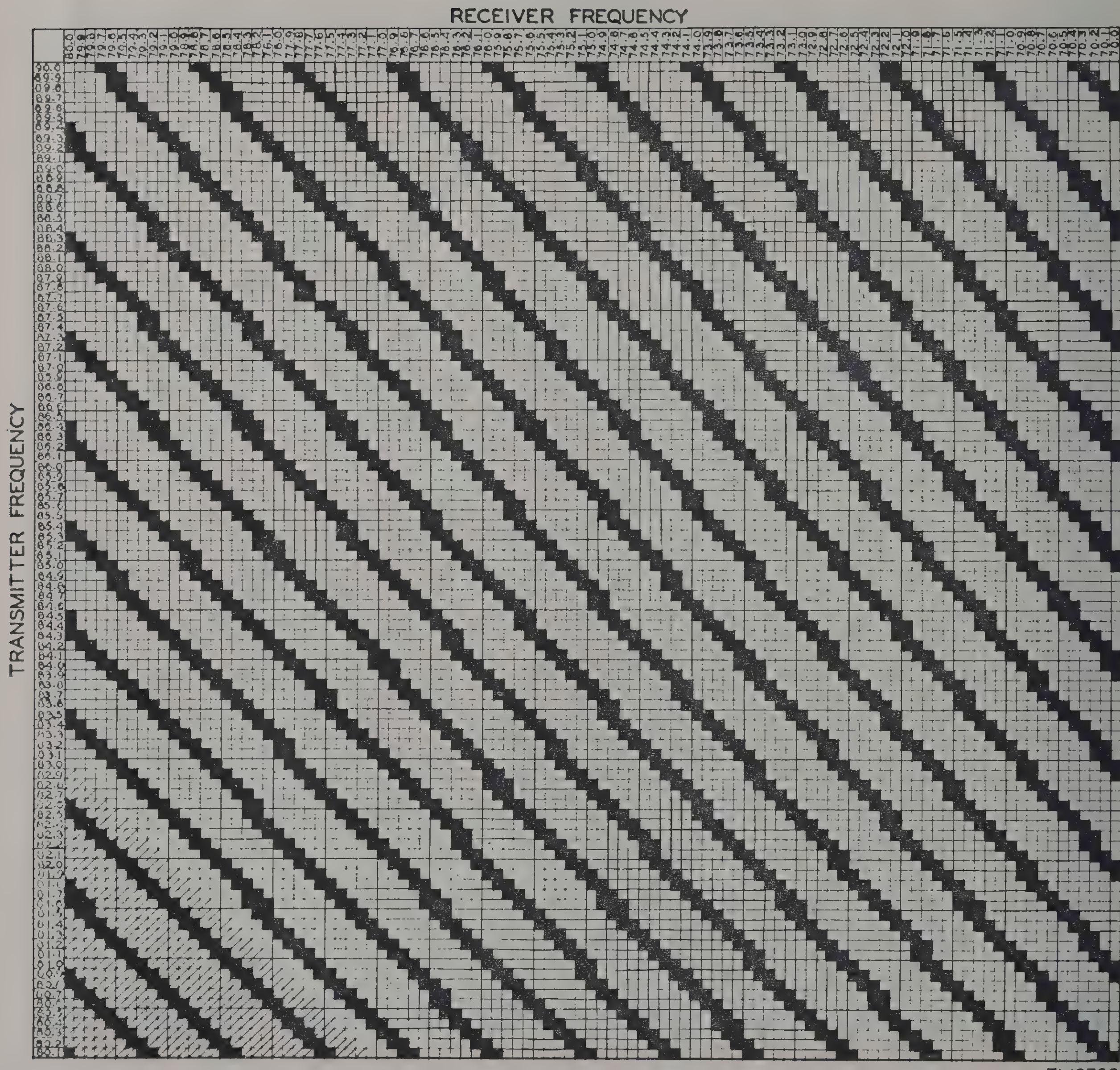

Figure 95. Interference chart; transmitter frequency 90 to 80 mc, receiver frequency 80 to 70 mc.

h. Radio Transmitter T–14H/TRC–1 and Radio Receiver R–19H/TRC–1 have been modified to reduce spurious radiation interference below the level found in earlier models. Combinations of communications equipment using H model sets (or sets of earlier models that have been reworked by applicable MWO's) may be able to operate with less mutual interference than combinations of the earlier models. Figures 90 through 98 and tables XII through XXI may not show all possible interference-free channels for the H model units.

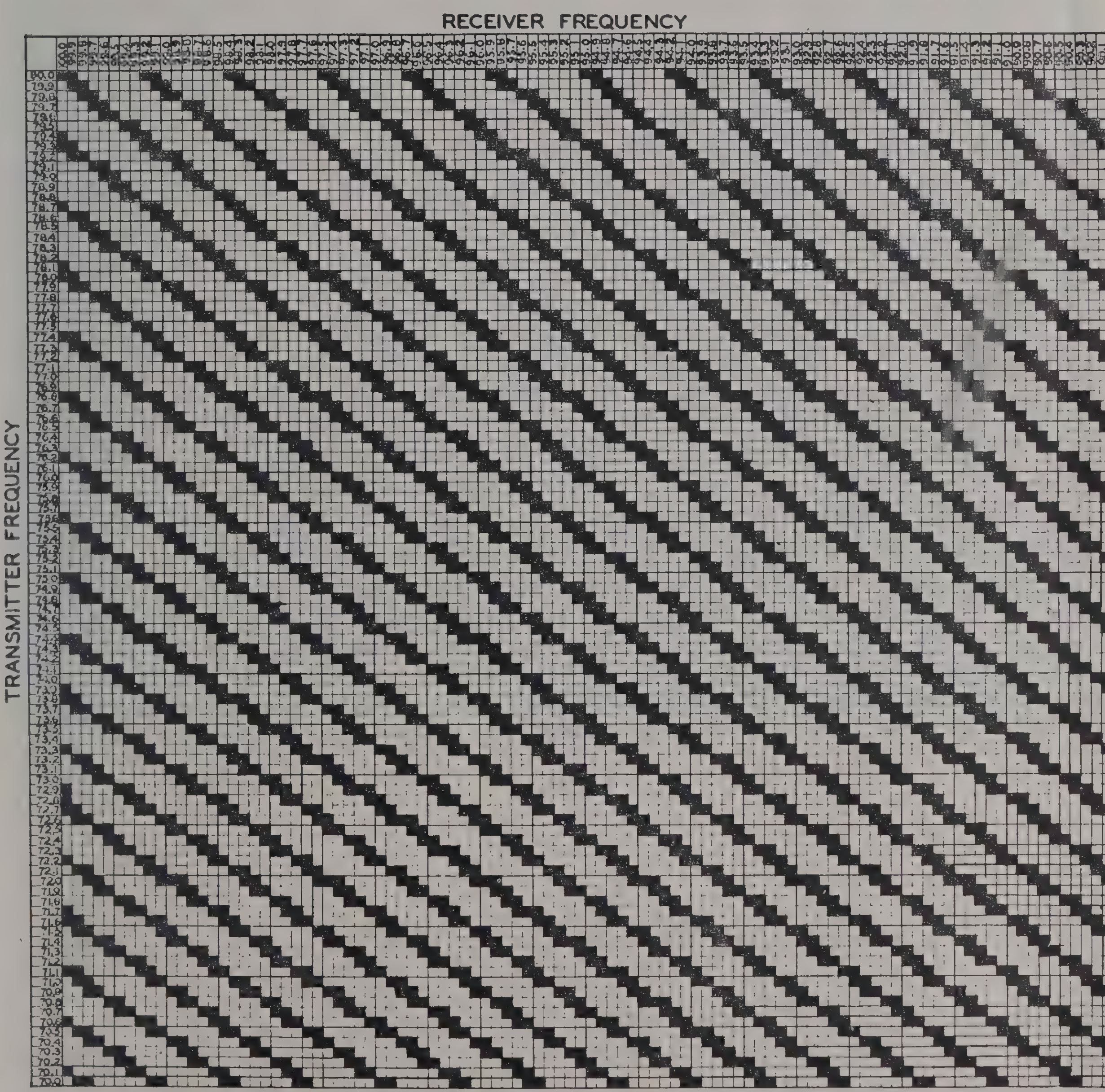

Figure 96. Interference chart; transmitter frequency 80 to 70 mc, receiver frequency 100 to 90 mc.

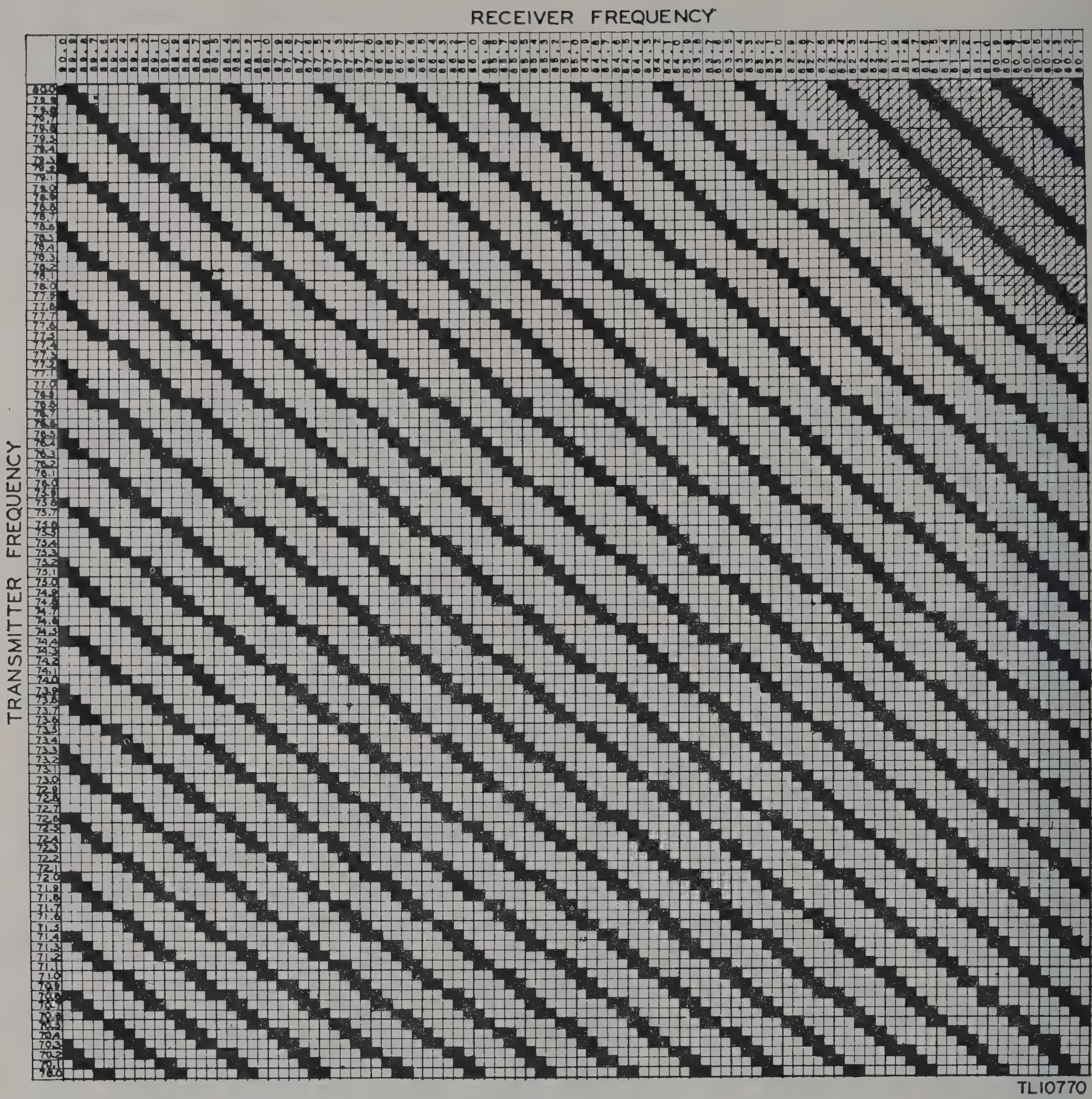

Figure 97. Interference chart; transmitter frequency 80 to 70 mc, receiver frequency 90 to 80 mc.

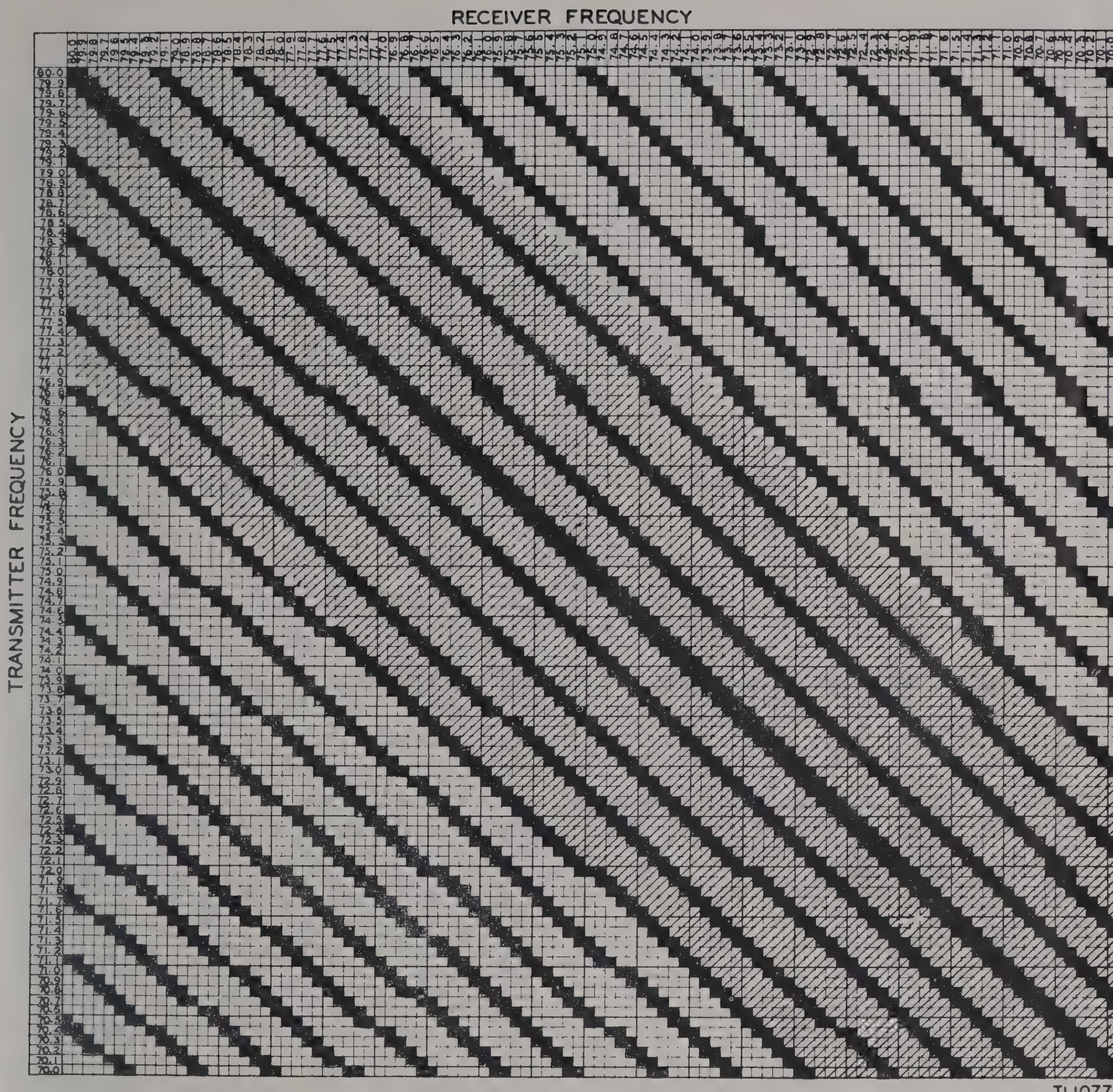

Figure 98. Interference chart; transmitter frequency 80 to 70 mc, receiver frequency 80 to 70 mc.

Table XII

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters
First	88.8	70.0
	89.2	70.1
	89.4	70.5
	96.7	70.6
	97.6	70.7
	98.4	70.8
	98.6	76.1
	98.8	76.7
	99.0	76.9
	99.2	77.6
	99.4	77.7
	99.6	77.8
	100.0	78.3
		78.4
		78.5

Choice	Receivers	Transmitters
Second	82.0	70.4
	82.2	74.0
	87.8	74.3
	88.6	76.8
	89.0	77.0
	89.6	77.5
	90.0	
	90.2	
	90.4	
	96.5	
	97.8	
	99.8	

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XII—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver													
70.0	82.0	89.2	89.4	96.7	97.6	98.4	98.6	99.2	99.4	99.6				
70.1	89.2	89.4	96.7	97.6	98.4	98.6	98.8	99.0	99.2	99.4	99.6			
70.5	88.8	97.6	98.4	98.6	98.8	99.0	99.2	99.4	99.6	100.0				
70.6	88.8	89.2	96.7	97.6	98.4	98.6	99.2	99.4	99.6	100.0				
70.7	88.8	89.2	96.7	97.6	98.4	98.6	98.8	99.0	99.2	99.4	99.6	100.0		
70.8	82.0	88.8	89.2	89.4	96.7	97.6	98.4	98.6	98.8	99.0	99.2	99.4	99.6	100.0
76.1	89.2	89.4	96.7	98.4	98.6	99.2	99.4	99.6	100.0					
76.7	88.8	89.2	96.7	97.6	98.6	99.2	99.4	100.0						
76.9	89.2	89.4	97.6	99.2	99.4	99.6								
77.6	98.4	98.6	98.8	99.0	99.6	100.0								
77.7	98.4	98.6	98.8	99.0	100.0									
77.8	98.4	98.6	98.8	99.0	99.2	100.0								
78.3	88.8	97.6	98.6	99.2	99.4	99.6								
78.4	97.6	98.6	98.8	99.0	99.2	99.4	99.6	100.0						
78.5	97.6	99.2	99.4	99.6	100.0									

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIII

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters
First	83.9	70.2
	84.7	70.3
	84.9	70.4
	86.0	71.2
	91.6	72.0
	91.8	72.8
	93.4	72.9
	93.6	73.0
	93.8	73.8
	94.0	73.9
	99.4	74.0
	99.6	74.2
	99.8	77.9
Second	86.2	70.1
	93.2	70.5
	95.9	71.1
		71.3
		71.4
		71.9
		72.7
		73.7
		74.1
		74.3
		74.4
		75.9
		76.0
		76.1
		77.8
		78.0
		80.2
		80.3
		80.4

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIII—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver									
70.2	83.9	84.7	84.9	91.8	99.4	99.6	99.8			
70.3	83.9	84.7	84.9	99.4	99.6	99.8				
70.4	83.9	84.7	84.9	86.0	93.4	99.4	99.6	99.8		
71.2	84.9	86.0	91.6	91.8	93.4	93.6	93.8	99.4	99.6	99.8
72.0	84.9	86.0	91.6	91.8	93.4	94.0	99.4	99.6	99.8	
72.8	84.9	91.6	91.8	93.6	93.8	99.4				
72.9	86.0	91.6	91.8	93.6	93.8	94.0	99.4	99.6		
73.0	86.0	91.6	91.8	93.8	94.0	99.4	99.6			
73.8	86.0	93.4	93.6	93.8	94.0					
73.9	86.0	93.6	93.8	94.0						
74.0	86.0	91.6	93.6	93.8	94.0	99.4				
74.9	91.8	93.4	93.6	93.8	94.0	99.4				
77.9	91.6	91.8	93.4	94.0	99.4					
80.3	93.6	93.8	94.0	99.4	99.6	99.8				

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIV

a. Centralized Operation Center Frequency Assignments

Choice	Receiver	Transmitters	Choice	Receiver	Transmitters
First	85.1	71.3	Second	85.3	71.4
	85.5	72.1		85.7	71.5
	85.9	74.2		86.1	71.9
	86.3	74.5		86.5	72.0
	92.4	74.8		94.2	72.2
	94.8	74.9		94.4	73.7
	95.0	75.0		94.6	73.8
	95.2	75.1		95.6	74.3
	95.4	75.2		96.2	74.4
	96.0	75.3		96.6	74.6
	96.4	------		96.8	74.7
				------	77.2
				------	81.5
				------	81.8
				------	81.9

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIV—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver					
71.3	85.1	85.5	85.9	92.4	96.0	------
72.1	85.1	85.9	86.3	94.8	95.0	------
74.2	86.3	95.4	96.0	------	------	------
74.5	94.8	95.0	96.0	96.4	------	------
74.8	92.4	94.8	95.0	95.2	95.0	96.4
74.9	94.8	95.0	95.2	95.4	96.4	------
75.0	86.3	94.8	95.0	95.2	95.4	96.4
75.1	86.3	94.8	95.0	95.2	95.4	96.4
75.2	95.0	95.2	95.4	------	------	------
75.3	95.2	95.4	96.0	------	------	------
81.9	92.4	95.2	95.4	96.0	------	------

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XV

a. Centralized Operation Center Frequency Assignments

Choice	Receiver	Transmitters
First	82.4	70.4
	84.4	70.7
	84.6	71.6
	87.6	71.7
	89.1	71.8
	91.2	72.7
	91.4	73.9
	91.6	74.1
	91.8	74.2
	92.0	76.5
	97.7	—
	97.9	—
	98.1	—
	99.1	—
	99.3	—
	99.5	—
	99.7	—

Choice	Receiver	Transmitters
Second	82.2	70.3
	83.0	70.5
	91.0	70.6
	98.3	70.8
	98.9	70.9
	99.9	72.6
	—	74.0
	—	76.2
	—	76.3
	—	76.6
	—	76.7
	—	78.7

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XV—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver													
70.4	82.4	84.4	84.6	87.6	91.2	91.4	92.0	97.7	97.9	98.1	99.1	99.3	99.5	99.7
70.7	84.4	84.6	89.1	91.2	91.4	91.6	91.8	97.7	97.9	98.1	99.1	99.3	99.5	99.7
71.6	91.2	92.0	97.7	97.9	99.1	99.3	99.5	99.7	—	—	—	—	—	—
71.7	84.6	87.6	91.2	91.4	97.7	97.9	98.1	99.1	99.3	99.5	99.7	—	—	—
71.8	82.4	87.6	89.1	91.2	91.4	91.6	97.7	97.9	98.1	99.1	99.3	99.5	99.7	—
72.7	87.6	91.2	91.4	91.6	97.7	97.9	99.1	99.3	—	—	—	—	—	—
73.9	89.1	91.4	97.9	98.1	99.3	—	—	—	—	—	—	—	—	—
74.1	89.1	91.6	98.1	99.5	—	—	—	—	—	—	—	—	—	—
74.2	87.6	89.1	91.8	97.7	99.7	—	—	—	—	—	—	—	—	—
76.5	91.2	91.4	91.6	91.8	92.0	99.1	99.7	—	—	—	—	—	—	—

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

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Table XVI

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters	Choice	Receivers	Transmitters
First	82.4	70.0	Second	84.5	70.1
	82.6	71.1		91.3	70.2
	82.8	71.7		91.5	70.3
	84.3	72.5		91.7	70.5
	91.9	72.6		92.3	71.4
	92.1	72.7		92.7	71.5
	92.9	72.8		93.1	71.6
	93.3	73.9		93.7	72.4
	93.5	74.0			72.9
	99.0	74.1			
	99.2	77.3			
	99.4				

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XVI—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver								
70.0	82.4	84.3	91.9	92.1	92.9	99.0	99.2	99.4	
71.1	82.6	91.9	92.1	92.9	93.3	93.5	99.0	99.2	99.4
71.7	92.1	92.9	99.0	99.2	99.4				
72.5	91.9	92.1	93.3	93.5	99.0				
72.6	92.1	93.3	93.5	99.0	99.2				
72.7	92.1	93.5	99.0	99.2	99.4				
72.8	92.9	93.5	99.0	99.2	99.4				
73.9	92.1	92.9	93.5	99.2					
74.0	82.8	92.9	99.2	99.4					
74.1	92.9								
77.3	92.1	92.9	93.3	99.4					

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XVII

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters	Choice	Receivers	Transmitters
First	70.4	92.2	Second	70.2	92.3
	70.6	93.5		71.3	92.4
	70.9	95.2		71.5	93.4
	71.1	97.9		72.4	97.8
	71.7	98.8		72.8	98.5
	71.9	98.9		78.0	98.7
	72.2	99.1		78.5	99.0
	72.6	99.3		78.9	99.2
	78.3	99.4		79.5	99.5
	78.7	99.6		81.4	99.9
	79.1	99.7		85.9	----------
	79.7	99.8		86.1	----------
	79.9	100.0			
	80.1	----------			

Note. Centralized operation center transmitter frequencies used on repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XVII—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver										
92.2	70.6	70.9	71.1	71.7	71.9	72.2	72.6	78.3	78.7	79.1	80.1
93.5	70.4	70.9	71.1	71.7	71.9	72.6	78.3	79.9	80.1	--------	--------
95.2	70.6	70.9	71.1	72.2	79.1	79.7	--------	--------	--------	--------	--------
97.9	70.4	70.6	70.9	71.7	71.9	72.6	78.7	79.1	79.9	80.1	--------
98.8	70.4	70.6	70.9	71.1	72.2	78.3	78.7	79.7	79.9	80.1	--------
98.9	70.4	70.6	70.9	71.1	72.2	72.6	78.3	78.7	79.9	80.1	--------
99.1	70.4	70.6	70.9	71.1	71.7	72.6	78.3	78.7	79.9	80.1	--------
99.3	70.4	70.6	70.9	71.1	71.7	72.6	78.3	78.7	79.1	80.1	--------
99.4	70.4	70.6	70.9	71.1	71.7	71.9	72.6	78.3	78.7	79.1	80.1
99.6	70.4	70.6	70.9	71.1	71.7	71.9	78.3	78.7	79.1	--------	--------
99.7	70.4	70.6	70.9	71.1	71.7	71.9	78.3	78.7	79.1	--------	--------
99.8	70.4	70.6	70.9	71.1	71.7	71.9	72.2	78.3	78.7	79.1	--------
100.0	70.4	70.6	70.9	71.1	71.7	71.9	72.2	78.3	78.7	79.1	79.7

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XVIII

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters	Choice	Receivers	Transmitters
First	71.0	92.2	Second	70.8	92.3
	71.3	92.4		72.1	92.5
	71.5	93.0		73.3	93.1
	71.7	94.0		78.9	93.9
	71.9	94.1		79.6	94.2
	72.4	99.0		80.1	94.3
	72.9	99.4		80.3	98.1
	73.1	99.5		80.5	98.2
	78.7	99.6		80.7	99.1
	79.1	99.7		87.8	99.3
	79.9	100.0		88.7	99.8
	81.8	--------			

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XVIII—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver									
92.2	71.0	71.5	71.7	71.9	72.4	72.9	73.1	78.7	79.1	--------	--------
92.4	71.0	71.7	71.9	72.4	72.9	73.1	79.1	81.8	--------	--------	--------
93.0	71.3	71.5	71.7	72.4	72.9	73.1	81.8	--------	--------	--------	--------
94.0	71.3	71.5	72.4	72.9	73.1	78.7	81.8	--------	--------	--------	--------
94.1	71.3	71.5	72.4	72.9	73.1	78.7	79.9	81.8	--------	--------	--------
99.0	71.0	71.3	71.5	72.4	78.7	79.9	--------	--------	--------	--------	--------
99.4	71.0	71.3	71.5	71.7	71.9	72.9	78.7	79.1	87.8	--------	--------
99.5	71.0	71.3	71.5	71.7	71.9	72.9	73.1	78.7	79.1	79.9	87.8
99.6	71.0	71.3	71.5	71.7	71.9	72.9	73.1	78.7	79.1	87.8	--------
99.7	71.0	71.3	71.5	71.7	71.9	72.9	73.1	78.7	79.1	87.8	--------
100.0	71.0	71.5	71.5	71.7	71.9	72.9	73.1	78.7	79.1	81.8	87.8

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIX

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters
First	71.0	93.5
	71.2	95.6
	72.3	95.8
	72.9	95.9
	76.9	96.0
	79.3	96.8
	79.5	98.9
	79.7	99.0
	80.1	99.3
	82.3	99.5
	82.7	99.6
	83.1	--------
	86.3	--------
Second	71.5	93.6
	72.5	95.5
	72.7	95.7
	79.1	96.9
	79.9	98.8
	82.1	99.1
	82.5	99.2
	82.9	99.4
	83.3	99.7
	86.1	--------

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XIX—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver									
93.5	71.0	71.2	72.9	79.3	80.1	82.3	82.7	--------	--------	--------
95.6	71.0	71.2	72.3	76.9	79.3	79.5	79.7	80.1	82.3	83.1
95.8	71.0	71.2	72.9	79.3	79.5	79.7	80.1	83.1	--------	--------
95.9	71.0	71.2	72.9	79.5	79.7	80.1	82.7	86.3	--------	--------
96.0	71.2	72.9	79.5	79.7	80.1	82.3	82.7	86.3	--------	--------
96.8	71.0	72.3	76.9	82.7	--------	--------	--------	--------	--------	--------
98.9	71.0	71.2	72.3	76.9	80.1	82.3	86.3	--------	--------	--------
99.0	71.0	71.2	72.3	76.9	79.5	80.1	82.3	86.3	--------	--------
99.3	71.0	71.2	72.9	76.9	80.1	82.3	82.7	86.3	--------	--------
99.5	71.0	71.2	72.9	76.9	79.3	82.7	86.3	--------	--------	--------
99.6	71.0	71.2	72.9	79.3	82.7	83.1	--------	--------	--------	--------

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XX

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters
First	70.5	92.3
	70.7	93.3
	71.0	93.5
	71.4	93.6
	72.7	93.7
	78.1	97.6
	78.3	97.8
	78.5	98.7
	79.6	98.8
	79.8	98.9
	80.0	99.0
	87.2	99.1
	------	99.4

Choice	Receivers	Transmitters
Second	71.2	------
	71.6	92.4
	71.9	93.4
	72.3	95.4
	72.5	97.7
	77.9	97.9
	78.7	98.6
	81.0	99.2
	81.2	99.5
	88.2	99.8
	------	99.9
	------	100.0

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XX—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver										
92.3	70.7	71.0	72.7	78.3	79.6	88.2	------	------	------	------	------
93.3	71.0	71.4	72.7	78.1	78.3	79.6	79.8	80.0	88.2	------	------
93.5	71.0	72.7	78.1	78.3	78.5	79.8	80.0	------	------	------	------
93.6	70.5	71.0	72.7	78.1	78.3	78.5	80.0	------	------	------	------
93.7	70.5	72.7	78.1	78.3	78.5	80.0	------	------	------	------	------
97.6	70.5	70.7	71.4	72.7	79.8	------	------	------	------	------	------
97.8	70.5	70.7	71.4	72.7	79.8	80.0	------	------	------	------	------
98.7	70.5	70.7	71.0	71.4	78.1	78.3	78.5	79.6	79.8	80.0	87.2
98.8	70.5	70.7	71.0	71.4	78.1	78.3	78.5	79.8	80.0	87.2	------
98.9	70.5	70.7	71.0	71.4	78.1	78.3	78.5	79.8	80.0	87.2	------
99.0	70.5	70.7	71.0	71.4	72.7	78.1	78.3	78.5	79.8	80.0	87.2
99.1	70.5	70.7	71.0	71.4	72.7	78.1	78.3	78.5	79.6	80.0	87.2
99.4	70.5	70.7	71.0	71.4	72.7	78.1	78.3	78.5	87.2	------	------

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XXI

a. Centralized Operation Center Frequency Assignments

Choice	Receivers	Transmitters
First	70.0	90.6
	70.2	91.4
	70.4	92.2
	70.9	97.0
	71.1	97.1
	75.6	97.2
	76.2	97.8
	76.9	98.1
	77.4	98.6
	77.6	98.7
	78.0	98.8
	78.2	98.9
	78.4	
	85.3	
Second	76.5	90.5
	76.7	90.7
	77.8	91.5
	83.6	91.6
	84.2	92.1
	84.4	97.7
	84.6	97.9
		98.0
		98.5
		99.0
		99.3
		100.0

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

Table XXI—Continued

b. Centralized Operation Center Frequency Combinations Suitable for Use With Automatic Repeater

Transmitter	Receiver									
90.6	70.2	70.4	70.9	71.1	75.6	77.4	77.6			
91.4	70.0	70.2	70.4	70.9	71.1	76.2	78.2	78.4		
92.2	70.2	70.9	71.1	76.9	77.4	85.3				
97.0	70.0	70.2	70.9	71.1	75.6	76.2	76.9	78.0	78.4	85.3
97.1	70.0	70.2	70.9	71.1	75.6	76.2	76.9	78.0	78.4	85.3
97.2	70.0	70.2	70.4	71.1	75.6	76.2	76.9	85.3		
97.8	70.0	70.2	70.4	75.6	76.2	76.9	77.4	77.6	85.3	
98.1	70.0	70.2	70.4	70.9	76.2	76.9	77.4	77.6	78.0	85.3
98.6	70.0	70.2	70.4	70.9	71.1	75.6				
98.7	70.0	70.2	70.4	70.9	71.1	75.6				
98.8	70.0	70.2	70 4	70.9	71.1	75.6				
98.9	70.0	70.2	70.4	70.9	71.1	75.6				

Note. Centralized operation center transmitter frequencies used on a repeater circuit should be separated at least .2 mc from any other assigned transmitter frequency.

135. Single-Channel System Control

a. Simplex Terminal Station (fig. 43). Single-channel simplex operation (par. 44) requires one Antenna System AS–19(*)/TRC–1 at each radio set location. In the normal or stand-by position, the antenna at each station is connected to the receiver through the antenna change-over relay. When the operator presses the push-to-talk switch of his handset, the change-over relay which is located in the transmitter disconnects the antenna from the receiver and connects it to the transmitter. In the D, E, and H models of the receiver and transmitter, the antenna change-over relay mutes the radio receiver while the transmitter is operating on LOCAL CONTROL, providing the MUTE ON-OFF switch is ON. This eliminates any possibility of audio feedback between the transmitter and the receiver; however, the high-fidelity circuit is not affected.

b. Simplex Relay Station. Control of a simplex relay station is explained in paragraph 44 and pictured in figure 43.

c. Duplex Terminal Station (fig. 44). With one Radio Set AN/TRC–1(*) at each of two positions within 25 to 50 miles of each other, duplex communication may be established between the two positions. Refer to paragraph 44*b* for an explanation of duplex terminal station control and to figure 75 for necessary cording between the equipments.

d. Duplex Relay Station (fig. 44). If the distance between the two terminal stations is over 25 miles, pairs of Radio Sets AN/TRC–1(*) may be located approximately 25 miles apart between the terminal stations. Each pair of Radio Sets AN/TRC–1(*) will serve as a radio relay station for both directions of communication. Figure 77 shows the necessary cording and paragraphs 45 and 46 explain duplex relay station control.

136. Single-Channel Simplex Terminal Station Operation

The CARRIER CONTROL switch on the transmitter (fig. 79) must be in the LOCAL CONTROL position for this type of operation. When the operator at one location wants to transmit, he pushes the switch on his handset and talks into the microphone. Since the antenna now is disconnected from the receiver, nothing can be received as long as the switch on the handset is depressed. After completing the transmission, the handset switch is released and the relay connects the antenna back to the receiver. The received signal will be heard in the loudspeaker, or if Cord CX–8/TRC–1 or CX–104/TRC–1 is connected between the transmitter and the receiver as shown in figures 74 and 75, the received signal will also be heard in the handset. The loudspeaker of the D, E, and H model receivers is grounded when transmitting in LOCAL CONTROL operation.

a. Receiver Control Settings (fig. 80).

(1) *A-C LINE.* Make sure that power is applied to the receiver by firmly inserting the power cord plug into a live 110- to 120-volt a-c receptacle.

(2) *LINE ON-OFF switch.* Throw the LINE ON-OFF switch to ON. The POWER ON green indicator should light.

(3) *LINE FUSE.* This should be checked first if the POWER ON indicator does not light.

(4) *PUSH FOR LINE CHECK switch.* Check for proper operating voltage by rotating the METER SWITCH to position 6 (AUDIO LEVEL AND LINE CHECK) and pushing the PUSH FOR LINE CHECK switch handle. Normal operating line voltage should be 115 volts as indicated by the meter needle matching with the red line on the meter face. The 0 to 100 meter scale must be multiplied by 2 to read a-c line volts. Voltages between 115 and 120 may be considered satisfactory. Adjust the voltage by turning the governor adjustment nut on the power unit, if the power source is Power Unit PE–75–(*). To increase the voltage, turn the nut to the right (clockwise); to decrease it, turn the nut to the left (counterclockwise). Make sure that the ridge on the bottom of the nut rests firmly in its locking groove after each adjustment. If the voltage remains too low, check that the power unit is not overloaded due to too many devices plugged into the line.

(5) *CONTROL CABLE receptacle.* Plug one end of interconnecting control cable Cord CX–8/TRC–1 or CX–104/TRC-1 into the CONTROL CABLE receptacle.

(6) *MUTE ON-OFF switch.* Throw to ON.

(7) *AUDIO GAIN control.* This control has no normal function in simplex local control operation.

(8) *SQUELCH ON-OFF switch and ADJUST control.* Turn the SQUELCH ON-OFF switch to ON and set the ADJUST control as described in paragraph 131*o*).

(9) *MULTICHANNEL-SINGLE CHANNEL switch.* Put in SINGLE CHANNEL position.

(10) *ANTENNA TUNING control.* Adjust the ANTENNA TUNING control as described in paragraph 131*n*).

(11) *SPEAKER ON-OFF switch and SPEAKER VOLUME control.* Throw the SPEAKER ON-OFF switch to the ON position and adjust the SPEAKER VOLUME control for the desired audio volume.

b. TRANSMITTER CONTROL SETTINGS.

(1) *A-C LINE.* Make sure power is applied to the transmitter by firmly inserting the power cord plug into a live 110- to 120-volt a-c receptacle.

(2) *LINE ON-OFF switch.* Throw the LINE ON-OFF switch to ON. The FILAMENT ON green indicator should light.

(3) *LINEFUSE.* This should be checked first if the FILAMENT ON indicator does not light.

(4) *CONTROL CABLE receptacle.* Plug the free end of Cord CX–8/TRC–1 or CX–104/TRC–1 into the CONTROL CABLE receptacle.

(5) *CARRIER CONTROL switch.* Place the CARRIER CONTROL switch in position 1 (LOCAL CONTROL).

(6) *POWER HIGH-LOW switch.* Place this switch in the LOW position for tuning up. Leave it in the LOW position during operation if a 10-watt output is sufficient for satisfactory communication. If 50 watts of output power are necessary, place this switch in the HIGH position.

(7) *H. V. FUSE.* If good, grid currents may be read on METER SWITCH positions 1 through 4 when the switch on the handset is depressed.

(8) *HEADSET and MICROPHONE jacks.* Insert Plugs PL–55 and PL–68 of Handset H–23(*)/U (or equivalent headset and microphone) into these jacks.

(9) *CABLE COMPENSATOR switch.* Place the switch at 0 dbm. This switch has no function at a simplex radio terminal station unless the high-fidelity input circuit is used for some special application.

c. AMPLIFIER CONTROL SETTINGS. If Amplifier AM–8(*)/TRA–1 is used with this equipment, set the controls as follows:

(1) *A-C LINE.* Make sure power is applied to the amplifier by firmly inserting the power cord into a live 110- to 120-volt a-c receptacle.

(2) *Filament ON-OFF switch.* Throw this switch to ON. Make sure that power is applied by noting that the green FILAMENT indicator lights.

(3) *TUNE OPERATE switch.* Place in the TUNE position. After the set has been tuned up (par. 132), place this switch in the OPERATE position.

(4) *PLATE switch.* The PLATE switch should be on and the red PLATE indicator lit.

(5) *GRID TUNING control.* Adjust the GRID TUNING control as described in paragraph 132*d* through *l*(1).

(6) *PLATE TUNING control.* Adjust the PLATE TUNING control as described in paragraph 132*d* through *k*.

(7) *ANTENNA LOADING control.* Adjust the ANTENNA LOADING control as described in paragraphs 128*c* and 132*e* through *l*(3).

d. OPERATING PROCEDURE.

(1) *To transmit.* Press the switch on the handset; this places Radio Transmitter T–14(*)/TRC–1 on the air. Talk

at a normal voice level *directly* into the microphone.

(2) *To receive.* Release the switch on the handset and listen to either the handset receiver or the loudspeaker. Adjust the SPEAKER VOLUME control for satisfactory audio volume in either case.

137. Single-Channel Simplex Relay Station Operation

In single-channel simplex relay operation, the operator at one terminal (for example, terminal A, fig. 43) presses the switch of his handset. This switch disconnects the antenna from the receiver and connects it to the transmitter. Transmitter plate power also is applied by this action. The transmitted signal on frequency F1 is picked up by the receiver at the relay position. When the carrier control switch is in SINGLE CHANNEL CARRIER OPERATE position, this signal closes the squelch relay of the receiver which, in turn, operates the plate relay of the associated transmitter. The receiver a-f output then modulates the transmitter. The transmitted carrier on frequency F2 is sent in both directions from the relay station, but is picked up only by the receiver at the right-hand terminal since the antenna at the left terminal is disconnected from the receiver. Communication from the right-hand terminal (B) to the left-hand terminal (A) passes through the relay station in the same manner. The cording diagram for a simplex radio-relay station using one Radio Set AN/TRC–(*) is similar to that for the duplex terminal station shown in figure 75. The only difference is that simplex relay operation requires that the jumper wires between the REC. and TRSG. binding posts be connected, while for duplex terminal operation they are not connected.

a. Normal Setting of Receiver Controls. Check the adjustment of all controls (except the MUTE ON-OFF switch) as outlined in paragraph 136*a* for single-channel simplex operation. The MUTE ON-OFF switch must be in the OFF position. In addition, the AUDIO GAIN control must be adjusted properly so that the level of the output signal from the receiver fully modulates the radio transmitter. This control can be adjusted properly by connecting Test Oscillator TS–32(*)/TRC–1 to the receiver exactly as is done when tuning the receiver (par. 131). Turn the MODULATION ON switch of the test oscillator to the ON position and adjust the AUDIO GAIN control of the receiver until the level indicating meter on the receiver reads +1 dbm when the METER SWITCH is in position 6. (The CABLE COMPENSATOR on the transmitter must be set at zero.) After the audio level is adjusted, disconnect the test oscillator. During operation this level adjustment should be checked occasionally by having one of the operators at either terminal station send a steady normal sound into his handset. The level indicating meter should be adjusted to read +5 dbm. This insures full modulation of the transmitter at the simplex relay station.

b. Normal Setting of Transmitter Controls. Check the adjustment of all controls (except the CARRIER CONTROL switch) as outlined in paragraph 136*b* for a simplex operation. The CARRIER CONTROL switch must be in position 2 (SINGLE CHANNEL CARRIER OPERATE). The CABLE COMPENSATOR must be set at 0.

c. Normal Setting of Amplifier Controls. When the amplifier is used, check all controls as described in paragraph 136*c* for single-channel simplex operation.

d. Operating Procedure. A simplex-repeater station often is left unattended except for routine service calls. The circuits are so set up, however, that the local operator at a simplex station may talk to either terminal station by means of a handset plugged into the HEADSET and MICROPHONE jacks on Radio Transmitter T–14(*)/TRC–1. This may be done without changing any adjustments or upsetting the repeater connection in any way. However, the operator should make certain that no communication is being relayed. This can be determined by listening in or observing that the CARRIER ON pilot light is not lit.

138. Single-Channel Duplex Terminal Station Operation

The r-f carrier of each transmitter (fig. 42) may be left on continuously or it may be controlled by the switch on the handset, depending on the position of the CARRIER CONTROL

switch on the transmitter. Normally, the CARRIER CONTROL switch is placed in the LOCAL CONTROL position so that the carrier is turned on and off by the handset switch. The received signal may be heard in the loudspeaker of the receiver, or if desired, the transmitter and receiver may be set alongside each other or one on top of the other and interconnected by Cord CX–8/TRC–1 or CX–104/TRC–1 (fig. 75). The received signal then may be heard in the handset. The speaker may be switched ON or OFF.

a. NORMAL SETTING OF RECEIVER CONTROLS. Check all controls (except the MUTE ON-OFF switch) as described in paragraph 136*a* for single-channel simplex operation. The MUTE ON-OFF switch must be in the OFF position. If the receiver is to be tied in with a telephone system, adjust the AUDIO GAIN control as described in paragraph 131*p*.

b. NORMAL SETTING OF TRANSMITTER CONTROLS. Check all controls as described in paragraph 136*b* for single-channel simplex operation.

c. NORMAL SETTING OF AMPLIFIER CONTROLS. When the amplifier is used, check all controls as described in paragraph 136*c* for single-channel simplex operation.

139. Single-Channel Duplex Relay Station Operation

a. The signal from the station at one end (fig. 44) is picked up by the relay receiver which is tuned to its frequency. The audio output from this receiver is conducted by the control cable to the associated transmitter. From the control cable socket pins of the transmitter, the a-f signal is conducted to the spiral-four cable terminals marked REC. (binding posts P1 and P2) which are connected by the jumpers to the TRSG. terminals (P4 and P5). The a-f signal then is fed into the input circuits of the transmitter, modulating the transmitter r-f carrier which is sent to the receiver at the opposite terminal station. The audio output from the relay receiver working in the other direction, modulates its associated transmitter in the same manner and relays the communication in the other direction.

b. At the relay position, the r-f carrier of each transmitter can be controlled (turned on and off) by the squelch circuit of the associated receiver or it may be left on continuously. In order to have the r-f carriers controlled by the associated receivers, it is necessary to have the CARRIER CONTROL switch at SINGLE CHANNEL CARRIER OPERATE (position 2). In order to have carrier left on continuously, the CARRIER CONTROL switch must be in the MULTICHANNEL CONTINUOUS position (SINGLE CHANNEL CONTINUOUS in the H model). When the switch is on SINGLE CHANNEL CARRIER OPERATE, the r-f signal from a terminal transmitter or other relay station transmitter is picked up by the relay receiver. The squelch relay of the receiver turns the transmitter r-f carrier on. The transmitter then is modulated by the audio output of the receiver in the manner explained in *a* above. The relay transmitter r-f carrier will remain on only as long as its associated receiver is picking up a signal (whether modulated or not) strong enough to operate the receiver squelch circuit. The squelch adjustment of each receiver will not respond to signals below the level of the desired signal. When on MULTICHANNEL CONTINUOUS (position 3 in the H model), the transmitter carriers are always on and the output of the receiver modulates the transmitter. The correct switch position must be used for either single-channel or multichannel continuous carrier operation.

c. At the relay position, the radio operator can monitor both receivers and communicate over either transmitter with his handsets.

d. Two Radio Sets AN/TRC–1(*) may be used as radio-relay stations at 25-mile intervals so as to extend the communication range of the system up to 100 miles. Such a communications system, consisting of two terminal stations (each using one Radio Set AN/TRC–1(*)) and three relay stations (each using two Radio Sets AN/TRC–1(*)) may be extended to cover distance as great as 150 miles. This distance will depend on the intervening terrain and the facilities for locating terminal and relay stations in high, clear positions in line with the communication path.

e. Check the adjustments of all receiver controls as instructed in paragraph 136*a* for

simplex operation with the following exceptions:

(1) Place the MULTICHANNEL SINGLE CHANNEL switch in the SINGLE CHANNEL position.

(2) Adjust the AUDIO GAIN control as described in paragraph 137*a*.

(3) Place the MUTE ON-OFF switch in the OFF position.

f. Check the adjustment of all transmitter controls (except the CARRIER CONTROL switch) as outlined in paragraph 136*b* for simplex operation. The CARRIER CONTROL switch must be in position 2 (SINGLE CHANNEL CARRIER OPERATE) for automatic carrier control, or in position 4 (MULTICHANNEL CONTINUOUS) if the transmitter carrier is to be left on continuously. Position 3 should be used with the H model for continuous carrier operation.

g. Check all Amplifier AM–8(*)/TRA-1 controls as described in paragraph 136*c* for simplex operation.

h. To operate proceed as follows:

(1) With Radio Set AN/TRC–1(*) adjusted for single-channel duplex repeater operation, normal operation of the equipment is automatic and only local supervisory control is necessary. The operator may use the radio facilities in either direction, but should always make sure that a conversation is not being repeated before he presses his handset button to enter the circuit. One handset is plugged into each transmitter. In order to communicate toward one terminal, it is necessary to talk into the microphone of one handset and listen in the earpiece of the other. By using both handsets at once in this manner, each operator can talk to the others as in a party conference.

(2) If the duplex relay station is made up of a Radio Relay Set AN/TRC–4(*) instead of two Radio Sets AN/TRC–1(*), Control Box C–21(*)/TRC–1 is available and only one handset is required at the relay station. Plugs PL–55 and PL–68, extending from the left-hand end of Control Box C–21(*)/TRC–1, should be inserted into the HEADSET and MICROPHONE jacks on the transmitter which is transmitting toward terminal A. Plugs PL–55 and PL–68, extending from the right-hand end of Control Box C-21(*)/TRC-1, should be inserted into the HEADSET and MICROPHONE jacks on the transmitter which is transmitting toward terminal B. Plugs PL–55 and PL–68 of a handset should be plugged into the HEADSET and MICROPHONE jacks of Control Box C–21(*)/TRC–1 (fig. 18). When the CIRCUIT DIRECTION switch on Control Box C–21(*)/TRC–1 is thrown to direction A, the headphone and microphone are so connected that, with the handset switch depressed, the operator may talk with the operator at terminal A or with the operator of any station between his station and terminal A. When the CIRCUIT DIRECTION switch is thrown to direction B, the headphone and microphone are so connected that the local operator may talk with the operator at terminal B or to the operator of any station between his location and terminal B. However, it is sometimes advantageous to be able to communicate in both directions simultaneously as described in (1) above.

(3) When the transmitter CARRIER CONTROL switch is in position 2 (SINGLE CHANNEL CARRIER OPERATE) and carrier control is being used, the local handset will enter the communication circuit and modulate the transmitter 100 percent. When the transmitter CARRIER CONTROL switch is in position 4 (MULTICHANNEL CONTINUOUS), the local handset will modulate the transmitter only 30 percent and the audio level of the handset signal may not be sufficient for good communication. If this is the case, it will be necessary to temporarily return the CARRIER CONTROL switch to position 1 or 2 in the unlettered through E models. In the H model, position 3 gives 100 percent modulation.

140. Single-Channel System Line-up

a. General. The procedure for making the communication system line-up depends on the type of service for which the radio circuit is to be used. For single-channel communication (radio without carrier equipment) where there are no relay stations and the high-fidelity input and output circuits are not used, there is no need for any circuit level line-up or line-up check; the only requirement is that the operator talk sufficiently loud in the handset, so that the transmitter is fully modulated, and that the receiver speaker or handset volume is adjusted to suit the needs of the operator. Therefore, in a single-channel communication system where one or more relays are used, it is necessary to maintain proper audio level adjustment at the relay stations only; the receiver output must be adjusted so that the associated transmitter is modulated the same amount as the transmitter at the starting terminal station. In a multichannel system, it is necessary that the audio level be held within close limits at both terminal stations and all relay stations.

b. Audio Level Adjustments, Single-Channel System.

(1) When the system comprises only two terminal stations, there are no audio level adjustments required for single-channel operation. The only time that any level adjustments may be required is when the high-fidelity input circuits of the transmitter and the narrow-band output circuits at the high-fidelity terminals are used.

(2) At the relay station of a single-channel system, it is necessary that the receiver level be adjusted so that the associated transmitter is modulated approximately the same amount as the transmitter at the starting terminal.

(3) After a single-channel communication system has been installed, each radio station should work toward getting in communication with each adjacent station. All stations must be in contact with their adjacent stations before a system audio level line-up can be started. For example, assume that a single-channel system comprises two Radio Terminal Stations, A and B, with four relay stations numbered 1, 2, 3, and 4. Terminal Stations A and B must establish communication with Relay Stations No. 1 and No. 4 respectively. Relay Station No. 2 must establish communication with Relay Stations No. 1 and No. 3. Relay Station No. 3 must establish communication with Relay Stations No. 2 and No. 4.

(4) The following instructions for initial line-up are outlined for a single-channel communication system comprising two Terminal Stations A and B with four Relay Stations No. 1, 2, 3, and 4. The same procedure is followed regardless of the number of relay stations. Terminal Stations A and B note that their respective radio transmitters and radio receivers are interconnected by Cord CX–8/TRC–1 or CX–104/TRC–1. After communication is established between each station and its adjacent stations, the system can be given an initial audio-level line-up as follows:

(*a*) Terminal Station A announces to Relay Station No. 1 that a system line-up is to follow. Relay Station No. 1 announces this to Relay Station No. 2 and so on to Terminal Station B. Terminal Station B acknowledges back to its adjacent Relay Station (No. 4) and so on back to Terminal Station A. As each station makes acknowledgment, the CARRIER CONTROL switch of each transmitter is switched to LOCAL CONTROL (position 1). When the acknowledgment gets back to the Terminal Station A, the line-up procedure starts immediately.

(*b*) Terminal Station A connects the REC. binding posts to the TRSG. binding posts on the transmitter by short jumper wires as is done at a simplex relay station.

(*c*) Terminal Station A disconnects the receiving antenna and connects Test

Oscillator TS–32(*)/TRC-1, tuned to the receiver frequency, in its place.

(*d*) Terminal Station A turns on the test oscillator with the tone modulation switch ON and adjusts the receiver gain control until the receiver meter reads +1 dbm with the receiver METER SWITCH in position 6.

(*e*) Terminal Station A allows the receiver to turn the transmitter carrier on by switching the CARRIER CONTROL switch of the transmitter to SIGNAL CHANNEL CARRIER OPERATE (position No. 2). Leave turned on for approximately 2 minutes.

(*f*) Relay Station No. 1 operator watches the receiver meter receiving the signal from Terminal A with METER SWITCH in position 6. As soon as the signal arrives (when the operation in (*e*) above is completed), immediately adjust the gain control of the receiver until the meter reads +1 dbm. Set the CABLE COMPENSATOR of the associated transmitter to 0 position. Then turn the transmitter carrier on by throwing the CARRIER CONTROL switch to position 2 (SINGLE CHANNEL CARRIER OPERATE). Leave it turned on. Make sure jumpers from TRSG. to REC. binding posts are in place.

(*g*) Relay Station No. 2 operator watches the receiver meter receiving the signal from Relay Station No. 1 with the METER SWITCH in position 6. As soon as the signal arrives (when the operation in (*f*) above is completed), immediately adjust the gain control of the receiver to read +1 dbm. Set the CABLE COMPENSATOR switch of the associated transmitter to 0 position. Then turn the transmitter carrier on by throwing the CARRIER CONTROL switch to position 2 (SINGLE CHANNEL CARRIER OPERATE). Leave it turned on.

(*h*) Relay Station No. 3 operator watches the receiver meter receiving the signal from Relay Station No. 2 with the METER SWITCH in position 6. As soon as the signal arrives (when the operation in (*g*) above is completed), immediately adjust the gain control of the receiver to read +1 dbm. Set the CABLE COMPENSATOR switch of the associated transmitter to 0 position. Then turn the transmitter carrier on by throwing the CARRIER CONTROL switch to position 2 (SINGLE CHANNEL CARRIER OPERATE). Leave it turned on.

(*i*) Relay Station No. 4 operator watches the meter of the receiver receiving the signal from Relay Station No. 3 with the METER SWITCH in position 6. As soon as the signal arrives (when the operation in (*h*) above is completed), immediately adjust the gain control of the receiver to read +1 dbm. Set the CABLE COMPENSATOR switch of the associated transmitter to 0 position. Then turn the transmitter carrier on by throwing the CARRIER CONTROL switch to position 2 (SINGLE CHANNEL CARRIER OPERATE). Leave it turned on.

(*j*) Terminal Station B operator watches the receiver meter receiving the signal from relay position No. 4 with the METER SWITCH in position 6. As soon as the signal arrives (when the operation in (*i*) above is completed), adjust the SPEAKER VOLUME control until the level of the signal is as desired. No adjustment of the gain control need be made at terminal B unless the high-fidelity circuits are going to be used for facsimile or teletypewriter operation. In this case, the gain control should be adjusted until the receiver meter reads the audio level required for the particular application. This is generally 0 dbm.

(*k*) After allowing approximately 2

minutes time for *each* of the relay stations and the Terminal B to get adjusted, Terminal Station A disconnects Test Oscillator TS–32(*)/TRC–1 from the receiver and disconnects the jumper wires from the TRSG. and REC. terminals of the transmitter. This operation will cause the transmitter of every relay station to drop out.

(*l*) Terminal Station A operator connects the receiving antenna back to the receiver, then presses the push-to-talk switch of the handset and announces that he has completed sending the line-up signal. As soon as it is acknowledged by each relay station, and Terminal Station B reports that each station is adjusted from A to B, Terminal Station A directs Terminal Station B to proceed with the audio-level line-up in the other direction. Each relay station stands by for the line-up.

(*m*) Terminal Station B then proceeds exactly as Terminal Station A starting with the operation in (*b*) above.

(*n*) The line-up procedure continues in the direction from terminal B to terminal A in exactly the same manner except in reverse direction.

141. Line-up Check

a. In the single-channel system (radio without carrier equipment), maintenance of the proper audio level is not of such importance as it is in a multichannel system (radio with carrier equipment). The level, however, should be maintained so that it will not be down at the start from the terminal or at any relay station, making it necessary to reestablish this level by a station which is not actually at fault.

b. When the single-channel system is in proper level alinement, an operator at either terminal, talking in a normal tone of voice, in his handset, will swing the audio-level meter (position 6) on every receiver along the line of communication to a reading of approximately +5 dbm on peaks.

c. The audio level should be checked at least twice a day by observing the amount of the meter swing for ordinary conversation from terminal to terminal.

d. The audio-level line-up should be reestablished at least once each day in the manner explained in paragraph 140.

142. Stopping Procedure

There is no definite procedure required for stopping a single-channel system (radio without carrier equipment) when communication is completed. When closing down the system is anticipated, each relay station operator should monitor closely so that the relay stations will not be shut down prematurely. After terminal A and terminal B have cleared all communication for the day or for the intended period of time, they should announce the fact and have it acknowledged by each relay station. When it is determined that every operator in the system is ready to shut down and that the equipment at each station is still in proper working order, the shut-down signal can be given by the controlling terminal. The controlling terminal should be the first to shut down, after having definitely established the time of reopening the circuit. Time synchronization checks should be made at intervals.

Section IV. MULTICHANNEL SYSTEM OPERATION

143. Selection of Operating Frequencies

As indicated in paragraph 134, operating frequencies for use in radio-relay communications systems must be carefully selected to avoid mutual interference. The following example is given to illustrate the procedure to be used in the selection and the installation of a group of crystals for use with the four-channel radio-relay communication system shown in figure 45. Under normal circumstances, frequency assignments will be obtained only through organization channels.

a. TERMINAL A.

(1) *Frequency F1.*

(*a*) Install a receiver crystal marked 71.2 MC. in Radio Receiver R–19(*)/TRC–1.

(*b*) Install a transmitter crystal marked 71.2 MC. in Test Oscillator TS–32(*)/TRC–1. Aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

(*c*) Adjust the receiver for normal operation, connect it to its antenna system, and make a listening test to determine the extent of noise or interference from other radio sets which may be in the vicinity. If interfering signals are relatively weak they may not be objectionable, since the desired signal from the distant relay set will probably be strong enough to control the receiver. Otherwise, another receiving frequency must be selected.

(2) *Frequency F2.* See the interference charts (figs. 90 through 98). Select a transmitter crystal marked 74.5 MC., and install it in Radio Transmitter T–14(*)/TRC–1. Aline the transmitter in accordance with the instructions outlined in paragraph 130. This 74.5-mc transmitter frequency is the lowest frequency which can be satisfactorily used with the 71.2-mc receiver frequency at the same location.

b. First Relay Station.

(1) *Frequency F1.* Install a transmitting crystal marked 71.2 MC. in the transmitter which is directed toward terminal A (fig. 45). Aline the transmitter in accordance with the instructions outlined in paragraph 130.

(2) *Frequency F2.*

(*a*) Install a receiver crystal marked 74.5 MC. in the receiver which is directed toward terminal A (fig. 45).

(*b*) Install a transmitter crystal marked 74.5 MC. in Test Oscillator TS–32(*)/TRC–1, and aline the receiver which is directed toward terminal A to this frequency in accordance with the instructions outlined in paragraph 131.

(3) *Frequency F3.*

(*a*) See the interference charts (figs. 90 through 98). Select receiver crystal marked 75.1 MC., and install it in the receiver which is directed toward the second relay station.

(*b*) Install a transmitter crystal marked 75.1 MC. in Test Oscillator TS–32(*)/TRC–1, and aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

(4) *Frequency F4.* See the interference charts (figs. 90 through 98). Select a transmitter crystal marked 70.3 MC., and install it in the transmitter which is directed toward the second relay station. Aline the transmitter in accordance with the instructions outlined in paragraph 130.

c. Second Relay Station.

(1) *Frequency F3.* Install a transmitter crystal marked 75.1 MC. in the transmitter which is directed toward the first relay station. Aline the transmitter in accordance with the instructions outlined in paragraph 130.

(2) *Frequency F4.*

(*a*) Install a receiver crystal marked 70.3 MC. in the receiver which is directed toward the first relay station.

(*b*) Install a transmitter crystal marked 70.3 MC. in Test Oscillator TS–32(*)/TRC–1 and aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

(3) *Frequency F5.*

(*a*) See interference charts (figs. 90 through 98). Select a receiver crystal marked 78.5 MC. and install it in the receiver which is directed toward the third relay station.

(*b*) Install a transmitter crystal marked 78.5 MC. in Test Oscillator TS–32(*)/TRC–1 and aline the receiver to this frequency in accordance with

instructions outlined in paragraph 131.

(4) *Frequency F6.* See the interference chart (figs. 90 through 98). Select a transmitter crystal marked 74.0 MC., and install in the transmitter which is directed toward the third relay station. Aline the transmitter in accordance with instructions outlined in paragraph 130.

d. THIRD RELAY STATION.

(1) *Frequency F5.* Install a transmitter crystal marked 78.5 MC. in the transmitter which is directed toward the second relay station. Aline the transmitter in accordance with the instructions outlined in paragraph 130.

(2) *Frequency F6.*

(*a*) Install a receiver crystal marked 74.0 MC. in the receiver which is directed toward the second relay station.

(*b*) Install a transmitter crystal marked 74.0 MC. in Test Oscillator TS–32(*)/TRC–1 and aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

(3) *Frequency F7.*

(*a*) Refer to the interference charts (figs. 90 through 98). Select a receiver crystal marked 73.0 MC., and install in the receiver which is directed toward terminal B.

(*b*) Install a transmitter crystal marked 73.0 MC. in Test Oscillator TS–32(*)/TRC–1 and aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

(4) *Frequency F8.* Refer to the interference chart (figs. 90 through 98). Select a transmitter crystal marked 79.4 MC., and install in the transmitter which is directed toward terminal B. Aline the transmitter in accordance with the instructions outlined in paragraph 130.

e. TERMINAL B.

(1) *Frequency F7.* Install a transmitter crystal marked 73.0 MC. in the transmitter which is directed toward the third relay station. Aline the transmitter in accordance with the instructions outlined in paragraph 130.

(2) *Frequency F8.*

(*a*) Install a receiver crystal marked 79.4 MC. in the receiver which is directed toward the third relay station.

(*b*) Install a transmitter crystal marked 79.4 MC. in Test Oscillator TS–32(*)/TRC–1 and aline the receiver to this frequency in accordance with the instructions outlined in paragraph 131.

144. System Control

Note. The information contained in this paragraph is a suggested method for system operation and can be used if other instructions are not issued by the proper authorities.

a. In a multichannel radio-relay system, the Telephone Terminal CF–1–(*) station of the senior unit (fig. 45) is designated *Terminal A Carrier* and the radio station as *Terminal A Radio.* At the opposite terminal they are called *Terminal B Carrier* and *Terminal B Radio.* Terminal A Carrier also is designated as the *System Control Station* and is responsible for the satisfactory operation of the over-all system. Any changes or adjustments, except those of an emergency nature, must be referred to the System Control Station for clearance.

b. Terminal A Radio, designated *Radio Control Station,* is responsible to the System Control Station for the satisfactory operation of the radio portion of the circuit and supervises all changes or adjustments in the radio system. This includes scheduling periodic tests and taking necessary action on reports of trouble. The Radio Control Station obtains permission from the System Control Station to make any changes which may affect service over the system.

c. In a single-channel radio-relay system, the Radio Control Station has complete charge. Stations other than the Radio Control Station should not make changes in the radio equipment which are likely to affect the operation of the over-all circuit without first obtaining permission from the Radio Control Station. In emergencies the Radio Control Station should be

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given complete information as soon as is practicable.

d. Terminal B Radio and Terminal B Carrier, designated as the Alternate Radio Control Station and Alternate System Control Station, respectively, assume control of the stations adjacent to them following a system break of any nature. The alternate control stations exercise all the functions of the control station in such cases.

145. Sample System Frequencies

a. Table XXII shows the allocation of operating frequencies for each of two parallel systems selected in accordance with the procedure outlined in paragraph 134. Table XXII shows frequencies for 30 typical radio-relay communication systems. Each system consists of two Radio Terminal Sets AN/TRC–3(*) and three Radio Relay Sets AN/TRC–4(*). It should be noted that systems No. 1 through No. 20 utilize only the 16 frequencies provided by the set of 32 crystals furnished with each type of radio set. The remainder of the systems utilize frequencies other than these 16. Crystals for the other frequencies are furnished only with Radio Terminal Set AN/TRC–3(*). Systems Nos. 21, 22, 23, and 24 utilize frequencies in the range of 70 to 80 and 80 to 100 mc; systems Nos. 25 and 26 utilize the frequency range 70 to 90 mc; systems Nos. 27 and 28 utilize the frequency range 80 to 100 mc; and systems Nos. 29 and 30 utilize random frequencies throughout the complete range of 70 to 100 mc. If it is necessary to operate two systems in parallel using the same installation sites, select a pair of the first 20 systems to avoid interference. The first 20 systems have been selected to permit the operation of systems Nos. 1 and 2, 3 and 4, and 5 and 6; etc., in parallel without mutual interference.

b. When individual stations in the relay systems are widely separated and the system is extended along a more or less straight line, economic use of operating frequencies can be achieved by reusing frequencies used elsewhere in the system. This is accomplished, for example, by the substitution of frequencies F1 and F2 for frequencies F7 and F8 (provided that F1 and F2 have been selected to avoid mutual interference with F5 and F6) (figs. 90 through 98). In general, it will not be advisable to reuse frequencies at intervals of less than 75 miles.

Table XXII. Frequency Assignment for Radio-Relay Communication Systems

System	Terminal A	1st Relay station		2d Relay station		3d Relay station		Terminal B
No. 1	93.8 T	93.8 R	78.0 T	78.0 R	93.0 T	93.0 R	73.4 T	73.4 R
	72.8 R	72.8 T	99.6 R	99.6 T	72.2 R	72.2 T	98.0 R	98.0 T
No. 2	90.6 T	90.6 R	74.0 T	74.0 R	95.4 T	95.4 R	76.0 T	76.0 R
	71.2 R	71.2 T	96.8 R	96.8 T	75.4 R	75.4 T	98.8 R	98.8 T
No. 3	74.0 T	74.0 R	95.4 T	95.4 R	78.0 T	78.0 R	99.6 T	99.6 R
	93.8 R	93.8 T	71.2 R	71.2 T	90.6 R	90.6 T	72.8 R	72.8 T
No. 4	75.4 T	75.4 R	96.8 T	96.8 R	73.4 T	73.4 R	98.0 T	98.0 R
	98.8 R	98.8 T	76.0 R	76.0 T	93.0 R	93.0 T	72.2 R	72.2 T
No. 5	71.2 T	71.2 R	90.6 T	90.6 R	76.0 T	76.0 R	93.0 T	93.0 R
	98.8 R	98.8 T	72.2 R	72.2 T	96.8 R	96.8 T	73.4 R	73.4 T
No. 6	74.0 T	74.0 R	95.4 T	95.4 R	78.0 T	78.0 R	93.8 T	93.8 R
	99.6 R	99.6 T	72.8 R	72.8 T	98.0 R	98.0 T	75.4 R	75.4 T
No. 7	72.8 T	72.8 R	90.6 T	90.6 R	71.2 T	71.2 R	93.0 T	93.0 R
	95.4 R	95.4 T	74.0 R	74.0 T	98.8 R	98.8 T	76.0 R	76.0 T
No. 8	78.0 T	78.0 R	96.8 T	96.8 R	72.2 T	72.2 R	99.6 T	99.6 R
	98.0 R	98.0 T	73.4 R	73.4 T	93.8 R	93.8 T	75.4 R	75.4 T

System	Terminal A	1st Relay station		2d Relay station		3d Relay station		Terminal B
No. 9	75.4 T	75.4 R	93.0 T	93.0 R	76.0 T	76.0 R	90.6 T	90.6 R
	99.6 R	99.6 T	73.4 R	73.4 T	93.8 R	93.8 T	72.8 R	72.8 T
No. 10	71.2 T	71.2 R	96.8 T	96.8 R	78.0 T	78.0 R	98.0 T	98.0 R
	98.8 R	98.8 T	74.0 R	74.0 T	95.4 R	95.4 T	72.2 R	72.2 T
No. 11	99.6 T	99.6 R	74.0 T	74.0 R	98.8 T	98.8 R	71.2 T	71.2 R
	78.0 R	78.0 T	90.6 R	90.6 T	76.0 R	76.0 T	95.4 R	95.4 T
No. 12	98.0 T	98.0 R	72.2 T	72.2 R	93.8 T	93.8 R	73.4 T	73.4 R
	75.4 R	75.4 T	93.0 R	93.0 T	72.8 R	72.8 T	96.8 R	96.8 T
No. 13	78.0 T	78.0 R	93.0 T	93.0 R	73.4 T	73.4 R	98.8 T	98.8 R
	93.8 R	93.8 T	76.0 R	76.0 T	98.0 R	98.0 T	75.4 R	75.4 T
No. 14	72.2 T	72.2 R	96.8 T	96.8 R	72.8 T	72.8 R	99.6 T	99.6 R
	95.4 R	95.4 T	74.0 R	74.0 T	90.6 R	90.6 T	71.2 R	71.2 T
No. 15	93.0 T	93.0 R	72.2 T	72.2 R	95.4 T	95.4 R	71.2 T	71.2 R
	74.0 R	74.0 T	98.8 R	98.8 T	73.4 R	73.4 T	90.6 R	90.6 T
No. 16	96.8 T	96.8 R	76.0 T	76.0 R	93.8 T	93.8 R	78.0 T	78.0 R
	72.8 R	72.8 T	98.0 R	98.0 T	75.4 R	75.4 T	99.6 R	99.6 T
No. 17	76.0 T	76.0 R	93.8 T	93.8 R	72.2 T	72.2 R	96.8 T	96.8 R
	99.6 R	99.6 T	74.0 R	74.0 T	93.0 R	93.0 T	78.0 R	78.0 T
No. 18	73.4 T	73.4 R	98.8 T	98.8 R	71.2 T	71.2 R	93.8 T	93.8 R
	98.0 R	98.0 T	75.4 R	75.4 T	90.6 R	90.6 T	72.8 R	72.8 T
No. 19	95.4 T	95.4 R	73.4 T	73.4 R	96.8 T	96.8 R	71.2 T	71.2 R
	72.8 R	72.8 T	93.0 R	93.0 T	76.0 R	76.0 T	93.8 R	93.8 T
No. 20	98.0 T	98.0 R	75.4 T	75.4 R	99.6 T	99.6 R	74.0 T	74.0 R
	78.0 R	78.0 T	98.8 R	98.8 T	72.2 R	72.2 T	90.6 R	90.6 T
No. 21	79.0 T	79.0 R	94.4 T	94.4 R	72.7 T	72.7 R	99.2 T	99.2 R
	99.0 R	99.0 T	74.6 R	74.6 T	92.7 R	92.7 T	78.8 R	78.8 T
No. 22	70.6 T	70.6 R	91.8 T	91.8 R	75.7 T	75.7 R	94.1 T	94.1 R
	93.6 R	93.6 T	79.6 R	79.6 T	97.9 R	97.9 T	78.2 R	78.2 T
No. 23	95.7 T	95.7 R	72.1 T	72.1 R	94.6 T	94.6 R	72.9 T	72.9 R
	78.1 R	78.1 T	97.2 R	97.2 T	77.5 R	77.5 T	98.1 R	98.1 T
No. 24	95.1 T	95.1 R	74.1 T	74.1 R	91.9 T	91.9 R	75.7 T	75.7 R
	78.5 R	78.5 T	97.7 R	97.7 T	77.0 R	77.0 T	96.7 R	96.7 T
No. 25	79.1 T	79.1 R	76.1 T	76.1 R	88.7 T	88.7 R	74.3 T	74.3 R
	70.5 R	70.5 T	86.3 R	86.3 T	71.8 R	71.8 T	80.9 R	80.9 T
No. 26	71.4 T	71.4 R	82.2 T	82.2 R	74.2 T	74.2 R	84.5 T	84.5 R
	84.3 R	84.3 T	76.9 R	76.9 T	89.4 R	89.4 T	71.5 R	71.5 T
No. 27	85.4 T	85.4 R	93.9 T	93.9 R	81.8 T	81.8 R	99.9 T	99.9 R
	95.5 R	95.5 T	87.7 R	87.7 T	93.3 R	93.3 T	86.2 R	86.2 T
No. 28	95.6 T	95.6 R	88.0 T	88.0 R	96.4 T	96.4 R	88.8 T	88.8 R
	82.9 R	82.9 T	97.8 R	97.8 T	84.0 R	84.0 T	99.5 R	99.5 T

System	Terminal A	1st Relay station		2d Relay station		3d Relay station		Terminal B
No. 29	84.2 T	84.2 R	72.5 T	72.5 R	99.1 T	99.1 R	70.9 T	70.9 R
	75.3 R	75.3 T	96.9 R	96.9 T	77.2 R	77.2 T	87.4 R	87.4 T
No. 30	89.4 T	89.4 R	77.7 T	77.7 R	96.0 T	96.0 R	74.6 T	74.6 R
	96.2 R	96.2 T	92.6 R	92.6 T	75.8 R	75.8 T	84.1 R	84.1 T

146. Multichannel Duplex Terminal Station Operation

a. General. Duplex operation may be defined as the use of a radio terminal set in a communication circuit where simultaneous transmission and reception on different frequencies and different antennas are required. Radio Terminal Set AN/TRC–3(*) or Radio Set AN/TRC–1(*) may be used as a terminal station in multichannel duplex system. The radio equipment is capable of simultaneously receiving and transmitting the four-carrier telephone channels. Before the equipment is put into operation, check the setting of controls on Radio Receiver R–19(*)/TRC–1 and Radio Transmitter T–14(*)/TRC–1 according to the following outline.

b. Normal Setting of Receiver Controls. Check all controls as described in paragraph 136*a* for simplex operation except:

(1) *MULTICHANNEL SINGLE CHANNEL switch.* Place in the MULTICHANNEL position.

(2) *MUTE ON-OFF.* Place in the OFF position.

(3) *AUDIO GAIN.* Adjust as described in paragraph 131*p*.

c. Normal Setting of Transmitter Controls. Check all controls as described in paragraph 136*b* for simplex operation with the following exceptions:

(1) *CABLE COMPENSATOR.* Set at 0 dbm if carrier Telephone Terminal Set TC–21 is within 1 mile of the radio set. For 1 mile of spiral-four cable, set CABLE COMPENSATOR at 1. If Telephone Terminal Set TC–21 is farther away and is connected with Radio Terminal Set AN/TRC–3(*) by means of spiral-four cable, increase the setting of the CABLE COMPENSATOR control allowing .8 dbm for each mile of cable. If no spiral-four cable is available, two circuits of field Wire W–110–B or WD–1/TT may be used as a replacement for distances up to 1 mile. In this case, allow 4 dbm per mile.

(2) *CARRIER CONTROL.* Set the switch in position 4 (MULTICHANNEL CONTINUOUS). This energizes the h-v power supply and places the transmitter in continuous operation. To turn off for servicing or inspection, rotate the CARRIER CONTROL switch back to position 1 (LOCAL CONTROL).

d. Normal Setting of Amplifier Controls. If the amplifier is used, check all controls as described in paragraph 136*c* for simplex operation.

e. Operating Procedure.

(1) When Radio Terminal Set AN/TRC–3(*) is adjusted, it is ready for the initial system audio-level line-up prior to transmitting or receiving multichannel carrier telephone messages. Of the four audio channels normally transmitted, the operator at the radio set can understand speech on only one, the lowest frequency channel. He can talk on only the lowest frequency channel.

(2) The loudspeaker and handset associated with the radio receiver monitor this one channel of the multichannel carrier telephone circuit coming into the radio terminal over the air. The handset can be used to talk over the same channel. The operator also may use his handset to communicate with

other relay or terminal stations in the same circuit without interfering with regular through telephone service on the other three channels. To talk to any other station, proceed as follows:

(a) Listen in on the loudspeaker or handset to be sure that no one else is using the circuit.

(b) Press the handset switch and call the station desired.

(c) The handset switch may be held down during the entire conversation, although loud local noises such as power unit and vehicle engine, gunfire, and other background noises will be picked up by the microphone.

147. Multichannel Duplex Relay Station Operation

a. GENERAL. Radio Relay Set AN/TRC–4(*) in operation in a multichannel duplex system acts exactly as two Radio Sets AN/TRC–1(*) or one Radio Relay Set AN/TRC–4(*) did in the single-channel duplex system except for the position of certain controls. Its function is to receive signals from two stations in opposite directions at the same time, amplify the signals, and retransmit them in the directions that they were originally traveling (fig. 45). Thus, each of the two transmitter-receiver combinations relays its signal in one direction only. *Make sure the jumpers from TRSG. to REC. binding posts are in place and interconnecting cables (fig. 77) have been connected properly.*

b. NORMAL SETTING OF RECEIVER CONTROLS. Check the adjustments of all controls as instructed in paragraph 136*a* for simplex operation except:

(1) *MULTICHANNEL SINGLE CHANNEL switch.* Place in the MULTICHANNEL position.

(2) *MUTE ON-OFF switch.* Place in the OFF position.

(3) *AUDIO GAIN control.* Adjust as described in paragraph 131*p*.

c. NORMAL SETTINGS OF TRANSMITTER CONTROLS. Check the adjustment of all controls (except CARRIER CONTROL switch) for simplex operation as instructed in paragraph 136*b*. The CARRIER CONTROL switch must be either in position 3 (MULTICHANNEL CARRIER OPERATE) for automatic carrier control or in position 4 (MULTICHANNEL CONTINUOUS) for continuous carrier operation under the control of the local operator for the unlettered through E models. Position 4 should be used in the H models.

d. NORMAL SETTING OF AMPLIFIER CONTROLS. When the amplifier is used, check all controls as described under paragraph 136*c* for simplex operation.

e. OPERATING PROCEDURE.

(1) With Radio Relay Set AN/TRC–4(*) adjusted for multichannel duplex relay operation, normal operation of the equipment is automatic and only local supervisory control need be exercised. The lowest frequency audio channel usually is used as the system service channel. Control Box C–21(*)/TRC–1 is provided for use at the duplex relay station to facilitate communication between the local operator and other operators on the circuit. To converse with both ends of the circuit at the same time, two handsets must be used plugged into each transmitter.

(2) Plugs PL–55 and PL–68, extending from the left-hand end of Control Box C–21(*)/TRC–1, should be inserted into the HEADSET and MICROPHONE jacks on the transmitter which is transmitting toward terminal A. Plugs PL–55 and PL–68, extending from the right-hand end of Control Box C–21(*)/TRC–1, should be inserted into the HEADSET and MICROPHONE jacks on the transmitter which is transmitting toward terminal B. Plugs PL–55 and PL–68 of Handset H–23/U should be plugged into the HEADSET and MICROPHONE jacks of Control Box C–21(*)/TRC (fig. 77).

(3) When the CIRCUIT DIRECTION switch on the control box is thrown to direction A, the headphone and microphone are so connected that, with the handset switch depressed, the operator may talk with the operator at

terminal A or to the operator of any station between his station and terminal A. When the CIRCUIT DIRECTION switch is thrown to direction B, the headphone and microphone are so connected that the local operator may talk with the operator at terminal B or to the operator of any station between his location and terminal B.

(4) The operator thus may use channel 1 without interfering with the other three communication channels that are being relayed through the circuit. The operator should listen in both directions before pressing the switch on his handset to make sure that no other party is using the circuit.

148. Multichannel System Line-Up

a. Figure 45 shows a block diagram of a complete four-channel radio-relay communication system.

(1) The radio equipment requirements for this system are two Radio Terminal Sets AN/TRC–3(*) and three Radio Relay Sets AN/TRC–4(*). Telephone Terminals CF–1–(*) and the associated telegraph and telephone equipment constitute a part of the complete communication system, but are not a part of the radio equipment and therefore are not described in this technical manual. See TM 11–341, TM 11–355, and TM 11–342 for information on Telephone Terminal CF–1–(*), Telegraph Terminal CF–2–(*), and Ringing Equipment EE–101–A, respectively.

(2) Radio transmitter T (fig. 45) of Radio Terminal Set AN/TRC–3(*) at Terminal Station A accepts the signals from Telephone Terminal CF–1–(*). These signals represent all of the communication originating at terminal A. They are passed through the three Radio Relay Sets AN/TRC–4–(*) along the path indicated by arrows F2, F4, F6, and F8 where they are delivered to the opposite Telephone Terminal CF–1–(*) by radio receiver R of Radio Terminal Set AN/TRC–3(*) at terminal B. In the same manner, all communication from terminal B is passed by relay equipment to terminal A over the path indicated by the lower set of arrows F7, F5, F3, and F1.

b. It is very important that the radio equipment in a multichannel communication system be adjusted to maintain the proper audio levels. Under normal and proper operating circumstances, all the communications originating at terminal A leave Telephone Terminal CF–1–(*) at an audio level corresponding to 0 dbm for each channel in use. With all four channels in use, the signal is approximately +6 dbm. The loss of signal level along the spiral-four cable feeding the radio transmitter must be compensated for by the CABLE COMPENSATOR adjustment on the transmitter so that the signal arriving at the transmitter appears to its modulating circuits as though it came directly from Telephone Terminal CF–1–(*).

c. Each channel at 0-dbm audio level modulates the transmitter 30 percent and all four channels modulate the transmitter 100 percent when the CABLE COMPENSATOR is adjusted to compensate for the cable between the radio transmitter and Telephone Terminal CF–1–(*). The receiver at the first radio-relay station must have its audio output level adjusted so that each channel modulates its associated transmitter 30 percent. Likewise, the audio levels must be adjusted and maintained properly at each relay station. At terminal B, the radio receiver must feed into the Telephone Terminal CF–1–(*) at the proper level.

d. Any radio set in the system which is not adjusted (all stages) or maintained properly will develop improper audio levels or excessive noise all along the line of communication. The proper procedure for lining up a system must be adhered to if satisfactory operation of the system is to be expected. *Extreme care must be taken in lining up systems using more than six relay stations.*

e. Making a multichannel system line up is simpler than making the single-channel system line up, because during the time that the test-tone signal is being sent, it is possible to use the order wire channel for communication between carrier terminals and radio terminal stations. It is thus possible to coordinate closely the ad-

justment at each position. As soon as one position is adjusted to proper level, the radio operator may announce that his station is adjusted so that the next station in line can start making adjustments. Any difficulties which may arise during the line-up can be discussed among the operators.

f. The following are instructions for Radio Terminal Station A:

(1) Set the METER SWITCH on both transmitter and receiver to position 6 (position 7 on the H model of the transmitter), the transmitter CARRIER CONTROL switch to MULTICHANNEL CONTINUOUS (position 4), and the receiver MULTICHANNEL SINGLE CHANNEL switch to MULTICHANNEL.

(2) Make sure the proper pairs of wires from the spiral-four cable are connected to the correct pairs of binding posts: light or white wires to REC., and dark or colored wires to TRSG. Connect Telephone EE–8–(*) to the two binding posts provided and crank the handle. The carrier terminal should answer. If several rings produce no results, check the incoming cable connections. Make sure the cable stub connector is inserted properly in the spiral-four line. If the circuit still remains open, the wire construction team must be notified. When two-way telephone contact has been made with the operator at Telephone Terminal CF–1–(*) located at terminal A position, instruct him to send test tone on channel 2 at 0-dbm level.

(3) Adjust the CABLE COMPENSATOR for the attenuation in the line from Telephone Terminal CF–1–(*) located at terminal A (.8 db per mile for spiral-four cable or 4 db per mile for Wire W–110–B or WD–1/TT).

(4) Instruct the first radio-relay station to proceed with the line-up.

g. The following are instructions for relay stations:

(1) Set the METER SWITCH on both transmitter and receiver to position 6 (position 7 on the H model of the transmitter), the transmitter CARRIER CONTROL switch to MULTICHANNEL CONTINUOUS (position 4), and the receiver MULTICHANNEL SINGLE CHANNEL switch to MULTICHANNEL.

(2) Adjust the AUDIO GAIN control of the receiver which is receiving from the direction of terminal A until the test meter reads 0 dbm.

(3) Instruct the next radio-relay station in line to proceed with the line-up.

h. Following are instructions for Radio Terminal Station B:

(1) Set the METER SWITCH on both transmitter and receiver to position 6 (position 7 on the H model of the transmitter), transmitter CARRIER CONTROL switch to MULTICHANNEL CONTINUOUS (position 4), and the receiver MULTICHANNEL SINGLE CHANNEL switch to MULTICHANNEL.

(2) Adjust the AUDIO GAIN control of the receiver until the test meter reads —5 dbm. Then make sure the operator at Carrier Terminal B can hear the tone on channel 2.

(3) Instruct the operator at Carrier Terminal A to remove the test tone.

i. The following is the audio-level adjustment from terminal B to terminal A. Start at terminal B and proceed with the line-up to terminal A as explained in *f* through *h* above, substituting A for B and B for A.

j. Upon completion of the adjustments of the radio stations, the operators at the carrier terminals should be notified on channel 1 or over the Telephone EE–8–(*) order lines to proceed with a normal line-up as used on wire circuits, equalizing the circuits with tone on all four channels at once.

(1) Remember that the carrier terminal operators cannot signal each other directly. It is, therefore, necessary for Radio Terminal A and B to listen for rings on their order line telephones continuously, since it is the duty of the radio terminal operators to notify the other radio terminal operator (over channel 1) to ring the other car-

rier terminal operator. Always make it clear to the carrier terminal operator that after he has finished his conversation on the system service channel, he must pick up his other phone and switch to channel 1 to talk to the other carrier terminal operator.

(2) When all required channels have been lined up by the carrier terminals, they are turned over to the local wire chief for use in handling communications traffic.

(3) All radio operators must realize that their equipment is now a part of an operating communication system. Any set adjustments, shut-downs of power units, and disconnections of antennas or other wires may break important conversations or teletype communications, and the operators may not even hear them. Permission must be obtained from the carrier terminals at both ends of the circuit before any station shuts down or makes any adjustments.

(4) Carrier operators should be immediately notified by radio terminal operators when severe fading on long circuits is present so that teletype and telephone switchboard operators can be notified. This saves many long delays that otherwise might have been but a few seconds in duration.

149. Multichannel System Line-Up Check

a. A periodic check of the audio levels existing throughout the system should be made at daily intervals, preferably at the same time as the recommended periodic check is made of the line-up of Telephone Terminal CF–1–(*).

b. The audio levels also should be checked in the following instances:

(1) Whenever a Radio Transmitter T–14(*)/TRC–1 or Radio Receiver R–19(*)/TRC–1 in the system is replaced.

(2) Whenever any component is repaired or replaced in the high-fidelity audio circuits of Radio Transmitter T–14(*)/TRC–1 or Radio Receiver R–19(*)/TRC–1 in the system.

(3) Whenever the operating frequency of any radio set in the system is changed.

(4) Whenever unsatisfactory or impaired operation of the sytem is indicated.

150. Communication between Radio and Carrier Terminals

a. To provide for communication from Telephone Terminal CF–1–(*) to Radio Terminal Set AN/TRC–3(*), connect Telephone EE–8–(*) to the binding marked SX TRSG and SX REC at the carrier terminal. This telephone is in addition to the one connected to the binding posts marked TEL. Talking and ringing over this added telephone is independent of the operation of any of the channels of Telephone Terminal CF–1–A–(*).

b. Connect Telephone EE–8–(*) to the transmitter binding posts marked TELEPHONE EE–8 (or EE–8 TEL.) at Radio Terminal Set AN/TRC–3(*).

c. To communicate with Radio Relay Sets AN/TRC–4(*), use the telephone connected to the binding posts marked TEL. When the added telephone is used, it will be impossible to signal either the radio-relay stations or the distant terminal, since the simplex circuit used for this purpose is no longer available.

Section V. MUTUAL INTERFERENCE CONSIDERATIONS

151. General

a. Whenever a number of Radio Sets AN/TRC–1(*), Radio Terminal Sets AN/TRC–3(*), or Radio Relay Sets AN/TRC–4(*) are operated in the same general vicinity, interference between the various transmitters and receivers may be encountered. As the number of equipments for an installation increases and where frequency assignment restrictions do not permit the use of the frequency assignment tables contained in paragraph 134, the problem of mutual interference becomes much more complicated. The purpose of this section is to outline methods of preventing mutual interference

between the components of the radio sets operating near each other.

b. To minimize the mutual interference, use frequencies listed in the frequency assignment charts and tables in Sections III and IV of this chapter. Other information on interference problems is contained in TM 11–486, Sections VI and VII, chapter 6.

c. In addition to the frequency assignment problems which are common to all radio sets, Radio Set AN/TRC–1(*) has other frequency assignment limitations. This condition exists because of spurious radiations from the transmitters and spurious responses in the receivers. The term spurious radiation refers to signals which are radiated from the transmitter on many frequencies other than the fundamental or carrier frequency. While these spurious radiations are weaker than the fundamental or carrier frequency, they are strong enough to cause interference in nearby receivers which may be tuned to a frequency which corresponds with one of the spurious radiations of the transmitter.

d. When Radio Receiver R–19(*)/TRC–1 is tuned to any one of the channels between 70 and 100 mc, it will respond to a signal on this frequency. However, there are other signals above and below the frequency to which the receiver is tuned that will be picked up by the receiver if the signals are strong enough. The responses of the receiver to other frequencies are called spurious responses.

e. It is possible for the local oscillator in a superheterodyne type receiver to radiate a signal which can cause interference. This condition is known as receiver radiation. However, in Radio Receiver R–19(*)/TRC–1, the radiation from the local oscillator is very weak and is seldom the cause of interference.

f. There are various ways in which mutual interference can occur. They are as follows:

(1) Transmitter fundamental radiation to receiver fundamental response.

(2) Transmitter spurious radiation to receiver fundamental response.

(3) Transmitter fundamental radiation to receiver spurious response.

(4) Transmitter spurious radiation to receiver spurious response.

(5) Receiver radiation to receiver fundamental response.

g. When the receivers are situated close to the transmitters, the frequency separation between the receivers and the transmitters should be greater than normal. This is due to the following:

(1) The transmitter has spurious radiations close to its transmitted frequency.

(2) The receiver will respond to some frequencies which are close to its tuned frequency.

h. At a radio terminal or relay station where the transmitter and receiver are located side by side and the antennas spaced approximately 60 feet apart, it is necessary that the frequency separation between transmitters and receivers be at least 3 mc. As the distance between the transmitter and the receiver at the site increases, this frequency separation can decrease. At a distance of approximately 2 miles from the transmitter, a receiver can operate within 300 kc of the transmitter frequency without any interference of this type.

i. The precaution of keeping the receiver frequencies separated at least 3 mc from the transmitter frequency does not mean that it is impossible to use less separation. There are combinations of transmitter and receiver frequencies which can be used within this ±3-mc region even though the transmitter and the receiver are at the same site. These useful combinations are somewhat unpredictable since they depend upon both the carrier level and the frequency at which the receiver is operating. Unless time is available for finding the usable combinations, it is best to keep the receiver and transmitter frequencies separated as much as possible.

j. Radio Transmitter T–14(*)/TRC–1 uses a frequency multiplication of 96 times the crystal frequency. This multiplication causes spurious frequencies to be radiated above and below the fundamental at intervals equal to the crystal frequency. For example, a transmitter operating on 96 mc uses a 1-mc crystal. Throughout the band of 70 to 100 mc there will be a spurious radiation at every 1-mc interval, making a total of approximately 30 spurious radiations. Many of these spurious radiations are too weak to cause interference, but some are strong enough to interfere with normal reception of receivers

located at the same installation and which may be tuned to the frequency of the radiation. This interference can be avoided by proper selection of operating frequencies.

k. Interference caused by fundamental radiation of the transmitter being picked up by the spurious response of the receiver is improbable, except where several transmitters and receivers are located at one site and the desired receiver signals are very weak.

(1) When the receiver is tuned to a particular frequency, most of the spurious responses which cause trouble do not occur in the exact frequency of the transmitter channel frequencies. Since the minimum channel separation of the transmitters is 3 mc, the probability of interference caused by the receiver spurious response to the transmitter fundamental is lowered considerably because most of the receiver spurious response will occur at frequencies between these 3-mc channels.

(2) In installations of not more than two transmitters and two receivers, where the received signal is above saturation of the limiters (60 or more on the meter scale of Radio Receiver R–19(*)/TRC–1, switch position 2), it is unlikely that spurious radiation from any transmitter will interfere with the receiver.

l. Interference caused by spurious radiations of the transmitter being picked up by the spurious responses of the receiver need to be given consideration only when a large number of transmitters and receivers are operated at one site and the received signal is weak. In a communication system where one or two transmitters and receivers are operated with the antennas located at least 60 feet apart and with the receivers operating with saturated limiters, no interference of this type will be encountered.

m. In Radio Receiver R–19(*)/TRC–1, the crystal oscillator-multiplier and the oscillator amplifier may originate spurious frequencies. These spurious frequencies radiate from the receiver case and the antenna system. The magnitude of these radiations is so low that they cannot normally be observed unless the receivers are removed from their wooden packing cases in which they normally operate and stacked one on top of the other (metal case to metal case), or operated side by side with the receiver lids open.

152. Methods of Reducing Interference

a. A transmitter causing interference in nearby receivers can be located by turning the r-f carrier on and off or by modulating the transmitter. A check of the receiver meter or loudspeaker will then reveal the offending transmitter. In some cases where there are several transmitters in operation, the interference may not be caused by a single transmitter. It is possible for two or more signals of the transmitters to mix in the r-f section of a nearby receiver and cause interference. This can happen even though either one of the transmitters alone does not cause any interference. The probability of this condition occurring is rare and likely to occur only when several equipments are in simultaneous operation near each other. To check for this condition, turn the r-f carrier of each of the transmitters on and off until the two offending transmitters can be isolated.

b. In some cases, the interference does not manifest itself as a modulated signal in the receiver but causes substantial increase in background noise. Sometimes this noise can be heard in the speaker of the receiver and can be related to the source of interference. Other times, this noise occurs at higher audio frequencies which are filtered out in audio circuits and cannot be heard in the loudspeaker circuits of the receiver. The latter condition is particularly troublesome in multichannel systems because the noise will fall into one of the upper carrier channels. The method of locating this type of interference is much the same as for other types, that is, observing the meter readings on the receiver, listening to the telephone carrier equipment in which the interference is observed, and turning the transmitters suspected of causing the interference off and on while noting any correlation of interference with the transmitter operation. After the source of interference has been located the steps outlined in table XXIII can be applied.

c. The following precautions should be observed to minimize interference at locations

where there are two or more equipments in operation:

(1) Keep the carrying cases separated at a minimum of 1 foot, or farther if possible. If the receivers are removed from the packing cases, keep them separated approximately 2 feet or more.

(2) Keep the antenna lead-in cables of each equipment separated. Do not coil the excess antenna cable of several equipments together.

(3) If a large number of radio sets have to be located at one site, the transmitters should be grouped and placed as far away as practicable from the receiver group. The greater the number of transmitters and receivers at the terminal, the greater should be the separation of the two groups. The separation distance required will vary approximately from 500 feet to one-fourth mile, depending upon the number of transmitters and receivers used. This separation of the transmitters and receivers beyond the distance permitted by the interconnecting cables will require auxiliary equipment. For data on remote operation, see section VII, chapter 6, TM 11–486, and TM 11–2621.

(4) If more than one system terminates at one location, consideration should be given to using vertical polarization in one or more of the systems. Late models of Antenna AS–20F/TRC–1 can be adjusted to emit vertically polarized waves (par. 65). Vertical rhombics may be used (their high gain may allow dropping the transmitter power to LOW or obviate the necessity of using Amplifier Equipment AN/TRA–1). Two systems, one vertically-polarized and the other horizontally-polarized, will have less mutual interference than two horizontally-polarized systems.

d. The stronger the desired signal, as compared to the spurious radiations, the less will be the noticeable interference. It is always desirable to operate the receivers above first limiter saturation, or at least 60 on the meter of Radio Receiver R–19(*)/TRC–1, with the switch in position 2. For that reason, the distance between the transmitter and the receiver of a particular radio link should not be so far beyond the line of sight that a weak signal will be received.

e. The physical relation of the transmitting and receiving antennas at any one site is often responsible for various types of mutual interference. In general, the interference problem is maximum when the transmitting antenna and the receiving antenna of one site are directed toward each other (front to front) and it is minimum when they are pointing in the same direction but located side to side. The spurious radiations may be radiated totally or in part from either the antenna array, antenna feed line, transmitter case, and hook-up cables. They may be picked up by the antenna array of the receiving antenna or, if the array offers high attenuation, they may be picked up by the receiver lead-in cable or by the receiver itself. The radiation from the side of the antenna is very small at the frequency for which it is adjusted compared to the forward or rear radiation. Likewise, the receiving response from the side is very low compared to the response from the front or even the rear (fig. 151). The transmitting and receiving antennas at a site should be placed side to side and separated as far as permitted by the antenna cables and the terrain. At a relay station the two transmitting antennas and the two receiving antennas should, if possible, all be in a single line perpendicular to the direction of communication.

f. Power Unit PE–75–(*) can be a source of interference because of the audible noise it makes. To decrease the level of this noise, proceed as follows:

(1) Make a reducing fitting of one nipple (Signal Corps stock number 6Z7245–7.1) and one coupling (Signal Corps stock number 6Z3433–9).

(2) Connect a flexible exhaust extension (Signal Corps stock number 3H1915–9/T51) with the reducing fitting to the exhaust of the power unit engine.

(3) Place the outlet end of the extension exhaust line in a fairly deep hole ap-

proximately 2 feet in diameter. In emergencies, when no exhaust extension is available, dig a hole about 4 feet in diameter and put the power unit in the hole. A smaller hole may cause the motor to overheat.

Table XXIII. Interference and Corrective Measures Summary

Type of interference in order of seriousness	Applications where considered	Precautions for minimizing
a. Transmitter fundamental radiation to receiver fundamental response.	*a.* All cases where receiving and transmitting antennas at site are separated less than 2 miles.	1. Use 3-mc frequency separation between transmitters and receivers at same site or group transmitters into one group and receivers into another group and separate groups at least one-fourth mile. 2. Orient transmitting and receiving antennas at the site side to side, or side to back (never front to front or front to back). If possible, avoid back to back.
b. Transmitter spurious radiations to receiver fundamental response.	*b.* All cases where receiving and transmitting antennas at the site are separated less than one-fourth mile.	1. Assign receiver frequencies so that they lie in between the spurious radiation intervals of the transmitter and at least 200 kc from any one of them. 2. Refer to figures 90 through 98 for assignments of transmitter and receiver channels. 3. Orient the transmitting and receiving antenna at the site, side to side, or side to back. If possible, avoid back to back. (Never use front to front or front to back.) 4. Keep antenna leads of transmitter separated from antenna leads of receiver. 5. Keep transmitters and receivers separated as far as interconnecting cables permit. 6. If large numbers of transmitters and receivers operate at one site, group transmitters into one group and receivers into another group and separate groups 500 feet to ¼ mile, depending upon signal strength at which receivers operate. 7. If large numbers of transmitters and receivers operate at one site and the signal strength at the receivers is weak, use the tables XII through XXI for selecting frequencies. 8. Provide good ground for transmitter cases.
c. Transmitter fundamental radiation to receiver spurious responses.	*c.* All cases where receiving and transmitting antennas at site are separated less than ¼ mile.	1. Same as for interference type given in *b* above, precautions 4, 5, 7, 8, and 9.
d. Transmitter spurious radiations to receiver spurious responses.	*d.* Where the receiving and transmitting antennas at site are separated less than 500 feet and the receiver carrier levels are approximately 5 microvolts or less.	1. Same for interference type given in *c* above.
e. Receiver radiations to receiver fundamental response.	*e.* Where two or more receivers must be operated at some site and must be located physically close together.	1. Orient receiving antennas side to side or side to back. Avoid all other positions if possible. 2. Keep receiver cabinets separated at least 2 feet. 3. Keep the antenna cables of the individual receivers separated. 4. Keep receiver covers closed and bottom plates in place. 5. Provide good ground for receiver cases.

153. General

The operation of these radio sets may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs instructions are given on procedures for minimizing the effect of these unusual operating conditions.

154. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the set is not in a heated inclosure, construct an insulated box for the set. Keep tube heaters (if supplied) turned on, provided this does not overtax the power supply. Keep the filaments of vacuum tubes lighted constantly, provided this does not overtax the power supply. This has the disadvantage of shortening the tube life.

c. Mercury-vapor tubes require more time to warm up than other vacuum tubes. Before turning on the plate voltage, turn on the filaments and let the tubes heat until they feel warm to the touch. This may take from 10 to 15 minutes, depending on the temperature of the surrounding air. If the tubes are not warm when the plate voltage is turned on, the heavy current surge, due to the high voltage, may ruin the tubes.

d. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened. A sudden draft of cold air is often sufficient to shatter the glass envelope of a heated tube. If the inclosure is so constructed that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

e. Heavy coatings of frost will gather on mouth-type microphones in extreme cold weather when the microphones are used in the open air or in a cold room. Frost will form from the breath in the small holes in the microphone cap and will affect transmitter modulation. Rubber and silk diaphragms have been designed to protect some types of microphones; use them when available. Have a spare microphone ready, if possible, in case the one in use fails to function properly.

f. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earcaps, since this action may render them useless. If water gets into the headset receivers, or if moisture condenses within them, it may freeze and impede the action of the diaphragm. When this happens, remove the bakelite cap and remove the ice and moisture from the receiver unit.

g. Use any improvised means to protect the dry batteries used with test equipment, since the batteries will fail if not protected against the cold. Preheat the batteries. To prevent heat loss, place them in bags lined with kapok, spun glass fiber materials, animal skins, or woolen clothing.

h. When the equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

155. Operation in Tropical Climates

a. When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground or when it is set up in swampy areas, it will be subjected to moisture conditions more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

b. The fungiproofing on all items must remain unbroken.

156. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of radio equipment, such as motors and power units. The ideal preventive precaution is to house the equipment in a dustproof shelter. However, since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

c. Never tie power cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 4, sec. II). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 4
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

157. Scope

This chapter outlines the specific duties and responsibilities of organizational maintenance personnel (operators and repairmen). The two phases of organizational maintenance are the prevention of breakdown in the equipment and the repair of any trouble that arises in spite of all precautions. Preventive measures include periodic cleaning, lubrication, and weatherproofing, as well as visual inspection of the electrical and mechanical characteristics of the components. Systematic recording and studying of performance characteristics such as meter readings is also important in the prevention of trouble. The general preventive maintenance techniques, discussed in paragraph 161, are those that can be performed with a minimum of equipment and effort. More extensive trouble-shooting and repair procedures will be given in chapter 7.

158. Tools and Materials

The following tools and materials, most of which are included in Tool Equipments TE–48–(*) and TE–113–(*), will be needed for the organizational maintenance procedures discussed in paragraphs 161 and 162:

- Screw drivers
- Wrenches
- Pliers
- Point file or relay burnishing tool
- Clean cloth
- No. 0000 sandpaper
- Crocus cloth
- Solvent, dry-cleaning (SD) (Fed. spec P–S–661*a*)

Note. Gasoline will not be used as a cleaning fluid for any purpose. Solvent, dry-cleaning (SD) is available as a cleaning fluid through established supply channels. Carbon tetrachloride will be used, if necessary, only on contact parts of electronic equipment. Do not use carbon tetrachloride where there is poor ventilation. The fumes have a toxic effect.

159. Special Tools

a. SHORTING STICK.

(1) *General.* The shorting stick (fig. 99), described in (2) below, is used to discharge capacitors before performing any preventive maintenance or trouble shooting. Normally, when the power in the equipment is turned off, capacitors will discharge to ground through bleeder resistors or voltage dividers. Should a failure occur in a discharging network and the capacitors remain charged, severe burns might result upon contact. The use of the shorting stick prevents such accidents.

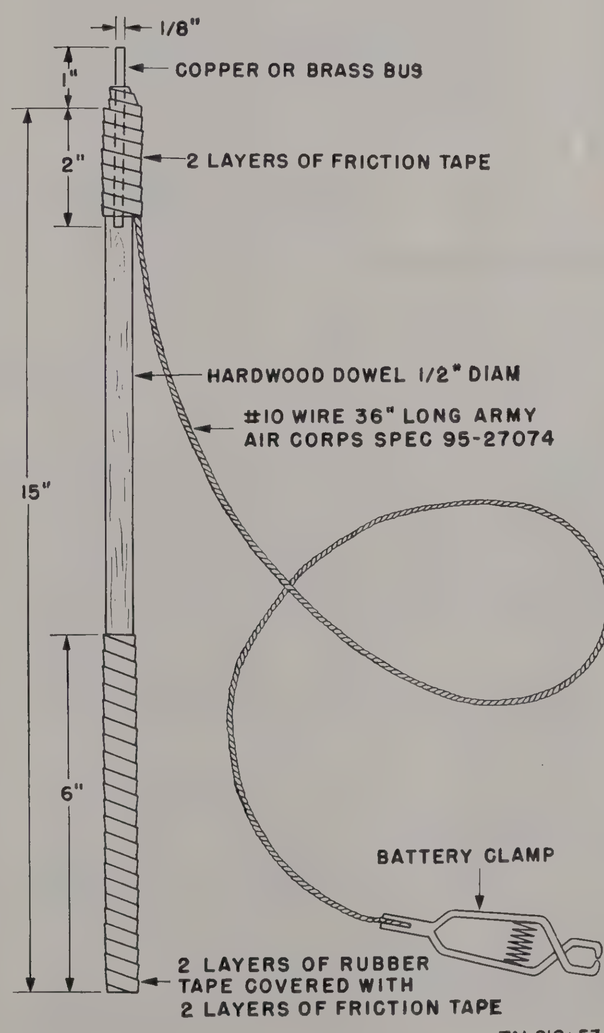

Figure 99. Shorting stick.

(2) *Fabrication of shorting stick.* Obtain a hardwood dowel, one-half inch in diameter and 15 inches long. Drill a 1/8-inch hole in the end of the dowel, extending 2 inches from the end (fig. 99). Press fit a piece of copper or brass bus wire into the hole, leaving approximately 1 inch of bus wire extending beyond the limits of the dowel. Solder one end of a 36-inch length of flexible, stranded No. 10 wire (Air Corps spec. 95–27074, or equal) to the bus wire, as close to the dowel as possible. Attach a battery clamp to the other end of the flexible wire. Apply several layers of friction tape over the soldered connection of the flexible wire and the bus wire, leaving approximately one-half inch of the bus wire extended untaped. Continue the tape from the soldered connection down over the dowel for a distance of 2 inches from the soldered joint. Apply two layers of rubber tape and two layers of friction tape to the opposite end of the dowel, extending the tape upward 6 inches to form an insulated handle for the shorting stick.

(3) *Use of shorting stick.* Connect the battery clamp to any known chassis ground that may be conveniently located near the capacitor to be discharged. Holding the shorting stick by the insulated handle, touch the exposed bus wire to the capacitor terminals.

b. Alinement Tool. An alinement tool suitable for h-f adjustments is necessary for tuning the i-f transformers. Three types of alinement tools have been issued with these equipments, the type depending upon the set model. All types have minimum h-f loss characteristics. Emergency alinement tools should contain as little metal as possible.

c. Other Tools. Tube pullers, screw drivers, and trouble lamps are included in the maintenance or accessory kits (fig. 22).

Section II. PREVENTIVE MAINTENANCE SERVICES

160. Definition of Preventive Maintenance

The best maintenance work is *preventive* in nature; potential failures are spotted and corrected before they have a chance to develop. This is accomplished by a definite sequence of operations performed on the equipment, when turned off, and by the systematic recording and studying of all performance, test, and servicing data. Preventive maintenance differs from trouble shooting and repair in that the former *prevents* breakdowns and subsequent repairs, while the latter locates and corrects *existing* defects. It is extremely important that repairmen and operators follow all preventive operations explicitly. See AR 750–5.

161. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent, dry-cleaning (SD); then wipe the parts with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 psi (pounds per square inch) to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. Components referred to in the table below are in the transmitter if numbered from 1 through 99, in the receiver if numbered from 101 through 199, in the amplifier if numbered from 201 through 299, in Power Supply PP–13(*)/TRA–1 if numbered from 301 through 399, and in the test oscillator if numbered from 401 through 499.

e. Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

f. For further information on preventive maintenance techniques, refer to TB SIG 178.

162. Performing Preventive Maintenance

The following preventive maintenance operations should be performed by organizational personnel at the intervals indicated, unless these intervals are reduced by the local commander.

DAILY

1. Clean exterior of cabinets.
2. Check operation of pilot lamps PL1, PL2, PL101, PL102, PL201, and PL202 and loudspeaker SP101.
3. Check readings of meters M1, M101, and M201.

WEEKLY

Disconnect all power before performing the following operations. Discharge high-voltage capacitors with the shorting stick (par. 159*a*) or similar tool. Upon completion of checks, reconnect power and check for satisfactory operation.

1. Clean interior of cabinets, exterior of all chassis, and all parts accessible without removal from cabinets.
2. Inspect electrolytic and paper capacitors for leakage of oil or dielectric, for bulging, and for heating.
3. Inspect power transformers T7, T8, T116, T201, T301, T302, and T303 for excessive heating.
4. Inspect fuses F1 through F4, F101, and F301 through F303 and all fuse holders for corrosion, cracks, and lack of tension sufficient to insure good contact.
5. Check meters M1, M101, and M201 for zero adjustment.
6. Check antenna and antenna connections.

MONTHLY

Make visual inspection of the following; tighten and/or clean *if necessary:*

1. Tube sockets and pins for loose contacts, dirt, and corrosion. Check vacuum tubes; replace if necessary (figs. 86 and 87). Note that tubes including final letters W or Y in their nomenclature can replace tubes of the same type: for example, 6SN7W can replace 6SN7.
2. Resistors, for blistering, discoloration, and other evidences of overheating.
3. Switches, for dirt, corrosion, loose contacts, and unsatisfactory mechanical action.
4. Plugs and jacks, for dirt, corrosion, and loose contacts.
5. Wires, cords, and cables, for cracked, cut, and frayed insulation.
6. Terminal boards, for cracks, dirt, and loose connections.
7. Potentiometers, for unsatisfactory electrical and mechanical operation.
8. Mountings, machine screws and nuts, for mechanical looseness.
9. All visible terminals and connections for loose connections and corrosion.
10. MFP (moisture-fungi-proof) coatings for breaks. Retouch with a brush, if necessary.
11. Finish, for scratches and bare spots. Retouch if necessary.
12. Variable capacitors C40 and C41 in the transmitter, C101 in the receiver, C201, C208, and C209 in the amplifier, and C407 in the test oscillator for dirt, corrosion, and bent plates.
13. Coils for dirt, corrosion, and damaged turns.
14. Insulators for cracks and dirt.
15. Relay contacts for pits and build-ups and for improper alinement.

Section III. LUBRICATION

163. Requirements and Lubricating

These equipments require very little lubrication. Only the ventilating fan motor and the worm gear drives on the main tuning capacitor are normally lubricated.

a. RADIO TRANSMITTER T–14(*)/TRC–1. A few drops of oil, lubricating, preservative, special, PS (U. S. Army spec 2–120) should be applied monthly to the ventilating fan motor. The worm gear drive for the final p-a tank tuning capacitor should be cleaned with solvent, drycleaning (SD) every three months. The worm gear should then be lightly coated (use approximately 1 gram) with grease, instrument (Military spec MIL–G–3278).

b. RADIO RECEIVER R–19(*)/TRC–1. A few drops of oil, lubricating, preservative, special, PS should be applied monthly to the ventilating fan motor.

c. AMPLIFIER AM–8(*)/TRA–1. A few drops of oil, lubricating, preservative, special, PS should be applied monthly to the ventilating fan motor. The worm gear drives for the GRID TUNING and PLATE TUNING capacitors should be cleaned and lubricated in the same manner as the transmitter p-a tank tuning capacitor (*a* above).

d. POWER SUPPLY PP–13(*)/TRA–1. A few drops of oil, lubricating, preservative, special, PS should be applied monthly to the ventilating fan motor.

e. OTHER EQUIPMENT. The test oscillator, control box, and other small parts of these equipments do not require lubrication.

f. POWER UNIT PE–75–(*). The power unit should be very carefully lubricated as its light construction and continuous (or almost continuous) duties will rapidly wear out the motor

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and generator units. See TM 11–900 for the proper lubrication instructions.

164. General Lubricating Instructions

a. Do not use excessive amounts of oil or grease and do not allow electrical connections to become greasy.

b. Make certain that lubricants and points to be lubricated are clean and free from sand, dirt, or grit. These abrasives are the chief cause of bearing wear and thus often cause breakdown of the motor bearings. Use solvent (SD) to clean all parts. Before lubrication, wipe clean all surfaces to be lubricated; use a lint-free cloth dampened with solvent (SD). Keep solvent off surrounding parts.

c. Oil, engine SAE 10 (OE 10) U. S. Army spec 2–104B is also satisfactory for use on the ventilating fan motors when the temperature is above 0°F.; it may be available when oil, lubricating, special, preservative, PS is not available.

165. Lubrication under Unusual Conditions

a. ARCTIC REGIONS. Lubricants which are satisfactory at moderate temperatures stiffen and solidify at subzero temperatures; as a result moving parts bind or become inoperative. When preparing the equipment for low-temperature operation, see that lubricants used for moderate temperatures are thoroughly removed. Even small amounts of such lubricants, if allowed to remain, may impair the operation of the moving parts. Be sure to use lubricants specified for low-temperature operation. The grease used on the worm gear drives should not congeal at a temperature of —40°C.

b. TROPICAL REGIONS. High temperatures and moisture due to rain, condensation, etc., may cause lubricants which are normally satisfactory to flow from moving parts and other surfaces. These bearing surfaces will wear excessively, and hinges, fasteners, and other parts will be damaged or destroyed by rust and corrosion. Inspect equipment daily and lubricate it as required to insure efficient operation, using lubricants suitable for high temperatures.

c. DESERT REGIONS. Dust and sand infiltration into the equipment causes grit in the lubricants and will seriously impair and damage the moving parts of the set. Hot dry temperatures cause the lubricants to flow from the moving parts, and conditions similar to those described in *b* above will result. Use lubricants suitable for high temperatures. Inspect and clean the equipment daily. Take the precautions prescribed in paragraph 156.

Section IV. WEATHERPROOFING

166. Weatherproofing

a. GENERAL. Signal Corps equipment, when operated under severe climatic conditions, such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials. Some of the problems encountered are—

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual breakdown.

(3) Breakdown of insulation on hook-up wires and cables. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flash-overs.

b. TROPICAL MAINTENANCE. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and excessive moisture. This treatment is explained in TB SIG 13 and TB SIG 72.

c. WINTER MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. DESERT MAINTENANCE. Special precau-

tions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. LUBRICATION. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all the precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme heat and cold. Refer to section III of this chapter for lubrication instructions.

167. Rustproofing and Painting

a. When the finish on a case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the radio set chassis and spray paint over the entire case. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust, and sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. Refer to TM 9–2851 for painting instructions.

Section V. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

168. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level is often limited in scope by the tools, test equipment, and replaceable parts issued and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The following paragraphs in this section help in determining which of the components, such as a receiver or transmitter, are at fault and in localizing the fault in that component to the defective stage or item, such as a tube or fuse.

c. Complete trouble localization procedures and the necessary follow-up repairs are discussed in chapter 7.

169. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Improperly connected cables.

(2) Worn, broken, or disconnected cords or plugs.

(3) Burned-out fuses.

(4) Burned or pitted relay contacts.

(5) Broken wires.

(6) Defective tubes.

b. Check the antenna for proper orientation and polarization or obvious abnormalties.

c. When failure is encountered and the cause is not immediately apparent, check as many of the items in *a* and *b* above as practicable, before starting a detailed examination of the component parts of the system.

d. It is helpful to have a record of normal performance data of the equipment when looking for the source of trouble. If such a record is not available, try to obtain information from the operator of the equipment regarding performance at the time of failure.

170. System Sectionalization of Trouble

a. GENERAL. System sectionalization consists of tracing the faults to the component or circuit responsible for the abnormal operation of the set. Localization, which is treated in chapter 7, means tracing the fault to the particular defective part responsible for abnormal operation.

(1) Careful observation of the performance of the radio set while turning the equipment on often sectionalizes

the fault to the transmitter or receiver. See the equipment performance checklist (par. 172) for normal operating indications.

(2) If only one component is dead, the trouble is probably in that component, and it probably is a fuse. Check fuses at an early stage in trouble shooting. Do not continue to burn out fuses before looking elsewhere to determine the basic source of trouble.

(3) Replace defective units with units known to be good whenever possible. If the trouble disappears, the replaced unit is definitely at fault.

b. SECTIONALIZING SYSTEM TROUBLE.

(1) *General.*

(*a*) The System Control Station (par. 144) is responsible for proper operation of both telephone and radio equipments. The operator at this station should be notified at once when trouble is indicated. If this is impossible, the Alternate System Control Station should be notified. The operator at the System Control Station should supervise the necessary repair. If it is impossible to notify the system control operator, and the trouble is of an emergency nature, the operator at the defective station should make the necessary repairs and then quickly notify the terminal station operator.

(*b*) If trouble occurs in the system and its location is not immediately determined, each station operator should inspect the equipment in use for satisfactory operation. The radio equipment may be checked in accordance with the equipment performance checklist (par. 172).

(2) *Sectionalizing trouble.* The location of trouble in the system may not be apparent. Trouble can be localized by testing:

(*a*) The spiral-four circuit between the terminal radio station and terminal telephone station at each end of the system.

(*b*) The radio circuit between terminal stations in both directions.

(3) *Sectionalizing an open circuit.* Table XXIV lists a sequence of steps to be followed for localizing trouble and lists

Table XXIV. Sectionalizing an Open Circuit

Steps	Remedy
1. Radio and telephone terminals communicate with each other by means of Telephone EE–8–B. If communication is not possible, the spiral-four cable circuit is defective.	1. Check spiral-four cable. See TM 11–369 and TM 11–2001.
2. If step 1 indicates no trouble, send a test tone on channel 1 from the telephone terminal over the TRSG pair of spiral-four. The tone should be heard at pin 1 of V1 with a headset. If there is no indication, the transmitter input circuit is defective.	2. Check transmitter. Refer to paragraph 172.
3. If step 2 indicates no trouble, tune the radio terminal receiver to the terminal transmitter frequency. If the test tone sent on the TRSG pair of spiral-four cable from the telephone terminal does not return to the same telephone terminal, place an output meter across the RECEIVER OUTPUT terminals on the receiver. A reading of less than .5 volt on the external output meter, when the transmitter is 100% modulated, indicates a defective receiver.	3. Check receiver. Refer to paragraph 172.
4. If steps 1 to 3 indicate no trouble, each radio terminal station (acting as Radio Control Station) calls each relay station in succession, starting with the nearest relay station, until an open circuit is indicated. This locates the particular station in trouble. Before calling the relay stations, disconnect one TRSG and one REC wire of spiral-four cable from the radio terminal set. Communication over Telephone EE–8–B is still possible.	4. Allow sufficient time (approx 30 min) for minor repairs or substitute spares. Then send help to relay station that does not answer.

methods of correction following a complete system break. By proper use of this table, the operator can save time that might otherwise be lost in checking components that are free of trouble.

c. SECTIONALIZING SYSTEM NOISE.

(1) Excessive noise in a system is caused by (pars. 151 and 152):

(*a*) Weak signal strength at any receiver.

(*b*) Defective or loose cables and connectors at any station.

(*c*) Interference from other radio equipment or ignition noise.

(2) In most cases of system noise, the cause is apparent and can be remedied easily. To check, follow table XXV. The Radio Control Station gives directions for any necessary corrections or repairs.

Table XXV. Locating System Noise

Symptom	Probable trouble	Remedy
1. Excessive receiver noise.	1. Signal strength weak at any receiver.	1. Check tuning of receiver and transmitter.
		Check that the antenna is pointed in the right direction.
		Check proper polarization of antenna.
		Substitute spare receiver or transmitter if necessary.
		If caused by poor line-of-sight transmission path, relocate the stations.
	Cables and connectors at any station defective or loose.	Inspect all cords and connectors.
		Clean and repair when necessary.
	Interference from other radio equipment.	Change to another assigned frequency.
	Ignition noise.	Make sure that the power unit is to the side of the antennas.
		Remove the cause of ignition noise.
	Key clicks from other radio equipment.	Suppress clicks or relocate equipment.
2. Howling or singing.	2. Feedback in receiver.	2. Reduce the setting of AUDIO GAIN control.

d. SECTIONALIZING TROUBLE TO MAJOR COMPONENT. Table XXVI sectionalizes the trouble to a major component at a particular radio station. Symptoms which may be recognized easily by the operator are listed and the probable location of trouble given.

171. Purpose and Use of Checklist

a. GENERAL. The equipment performance checklist (par. 172) will help the operator to determine whether Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), Radio Relay Set AN/TRC–4(*), and Amplifier Equipment AN/TRA–1(*) are functioning properly. The checklist gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures that the operator can take. Items 1 to 15 are checked before starting, items 16 to 19 when starting, items 20 to 35 during operation, and items 36 to 40 when stopping Radio Receiver R–19(*)/TRC–1, Radio Transmitter T–14(*)/TRC–1, or Amplifier AM–8(*)/TRA–1. Items 20 to 35 on this checklist should be checked at least once during a normal operating period or at least four times a day during continuous operation.

b. ACTION OR CONDITION. For some items the information given in the action or condition column consists of the settings of various switches and controls under which the item is to be checked. For other items it represents an action that must be taken in order to check the normal indication given in the normal indications column.

c. NORMAL INDICATIONS. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. In the case of meter readings, the allowable tolerance of the readings are given. When a meter reads between the limits specified, the operations can be considered satisfactory. A meter reading outside the limits given is a sign of impending trouble. If the indications are not normal, the operator should apply the recommended corrective measures.

d. CORRECTIVE MEASURES. The corrective measures listed are those that the operator can make without turning the equipment in for re-

Table XXVI. Locating Defective Major Component

Symptoms	Probable trouble	Remedy
1. Transmitter and receiver dead. Pilot lamps out.	1. Power Unit PE–75–(*) inoperative	1. Check Power Unit PE–75–(*).
	Junction Box J–85/G defective	Repair.
	Cord CD–711 defective	Do.
	Junction Box JB–110 defective	Do.
	Power cords of receiver or transmitter are defective.	Do.
	Blown fuse	Replace fuse.
2. Equipment inoperative. Pilot lights on receiver and transmitter lighted.	2. Interconnecting cables improperly connected or connectors not making good contact.	2. Check interconnecting cables and tighten connectors.
	Controls on receiver and transmitter not properly set for operation.	Check control settings and reset if necessary.
	Defective tubes	Replace defective tubes. Check meter readings to help determine defective tube.
3. Receiver and transmitter in same direction operative, but communication poor.	3. Intervening terrain causes excessive attenuation of signal.	3. Select better operating sites.
	Antennas not directed properly	Check antenna direction and polarization.
4. Receiver dead. Pilot lamp out	4. Fuse F101 blown	4. Replace fuse.
	Poor connection into Junction Box JB–110.	Repair.
5. Transmitter dead. Pilot lamp out	5. Line ON-OFF switch snapped OFF	5. Throw to ON.
	Poor connection into Junction Box JB–110.	Repair.
6. Receiver dead. Pilot lamp normal. No meter readings.	6. Defective receiver	6. See paragraph 172.
7. Transmitter dead. Pilot lamp normal. No meter readings.	7. Defective transmitter	7. See paragraph 172.
	Plate relay RL1 inoperative	Repair relay.
	CARRIER CONTROL switch defective.	Repair.
8. Receiver dead. Pilot lamp normal. Meter readings normal.	8. SQUELCH control out of adjustment.	8. Readjust.
	Squelch relay RL101 inoperative	Repair relay.
9. Receiver signals weak. Meter readings normal.	9. Open or shorted coaxial cable	9. Replace.
	Antennas improperly polarized	Check polarization.
10. No transmitter output. Meter readings normal.	10. Open or shorted coaxial cable or antenna dipole faulty.	10. Replace.

pairs. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so. Spare components are provided with Radio Terminal Set AN/TRC–3 and Radio Relay Set AN/TRC–4 to insure continuous trouble-free operation. The corrective measures listed in the last column of the checklist are to be performed if the readings for the various tests do not agree reasonably with the chart.

e. ITEMS 1 TO 19. Items 1 to 19 should be checked each time the receiver, transmitter, and amplifier are put into operation.

f. ITEMS 20 TO 26. The operator should familarize himself with the operation of Radio Receiver R–19(*)/TRC–1 so that he knows the characteristics of its reception of normal signals.

g. ITEMS 27 TO 32. Items 27 to 32 show correct meter readings on Radio Transmitter T–

14(*)/TRC–1 when the transmitter is properly tuned and in operation. The meter readings must be taken with the switch on the handset pressed since this applies plate power to the transmitter.

h. ITEMS 33 TO 35. Items 33 to 35 show correct meter readings on Amplifier AM–8(*)/TRA–1 when the amplifier is properly tuned and in operation. The meter readings must be taken with the switch on the handset pressed since this applies plate power to the transmitter which is driving the amplifier.

i. ITEMS 36 TO 40. Items 36 to 40 are checked whenever the station is taken out of operation. Any abnormal indications at this time are probably caused by trouble in the set and should be corrected before the next expected period of operation.

172. Equipment Performance Checklist

Radio Receiver R–19(*)/TRC–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Tubes	All tubes are in place.		
	2	Crystal	Proper crystal installed in crystal socket.		
	3	Transmitter crystal	Proper crystal placed in crystal socket of test oscillator.		
	4	Plug P402 of test oscillator.	Inserted into socket P106 of receiver.		
	5	Test oscillator TUNING control.	Set to operating frequency.		
	6	A-C LINE power cord	Connected to receiver and power source.		
	7	Tuning controls on T102, T103, T104, T105, T110, and T111.	Set to desired frequency (par. 131).		

Radio Transmitter T–14(*)/TRC–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	8	Tubes	All tubes are in place.		
	9	Crystal	Proper crystal installed in crystal oven.		
	10	CARRIER CONTROL switch.	Turned to LOCAL CONTROL.		
	11	POWER HIGH-LOW switch.	Placed in the LOW position.		
	12	Handset	Plugs inserted into HEADSET and MICROPHONE jacks.		
	13	Power cord	Primary power connected to transmitter.		
	14	Tuning controls of transformers T1, T2, T3, T4, T5, and (in D, E, and H models) T11.	Pretuned to desired operating frequency (par. 130).		

Amplifier AM-8(*)/TRA-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	15	R-f input to Amplifier AM-8(*)/TRC-1.	ANTENNA output of Radio Transmitter T-14(*)/TRC-1 is connected to R-F INPUT of the amplifier by coaxial cable.		
	16	Power cord of power supply.	Plugged into 115-volt a-c source.		

Radio Receiver R-19(*)/TRC-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	17	LINE ON-OFF switch	Throw to ON position	Receiver POWER ON lamp lights. Filament and plate circuits of receiver and test oscillator are energized.	Check connections and fuses.

Radio Transmitter T-14(*)/TRC-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	18	LINE ON-OFF switch S1	Throw to ON position	The FILAMENT ON (green) pilot lamp lights. Filaments light.	Check connections and fuses.

Amplifier AM-8(*)/TRA-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	19	Filament ON-OFF switch	Turn to ON position	Filaments and bias supply are energized. Green FILAMENT pilot lamp lights.	Check connections and fuses.

Radio Receiver R–19(*)/TRC–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	20	SPEAKER VOLUME control.	Rotate control for maximum volume. (SQUELCH switch in OFF position.)	Loud rushing noise will be heard in the loudspeaker.	Check to see that all tubes are warm and securely seated in their sockets.
	21	Loudspeaker	Set operating normally. SPEAKER switch ON.	Signal is heard	See paragraph 131 for tuning of receiver.
	22	Test Oscillator TS–32(*)/TRC–1.	R-F OUTPUT of oscillator connected to ANT. INPUT on receiver.		
			Test oscillator CARRIER switch ON.	Signal from oscillator suppresses noise.	See paragraph 131.
	23	First limiter grid current	METER SWITCH in position 1. R-F OUTPUT of test oscillator connected to ANT. INPUT on the receiver. Output of oscillator is reduced by detuning test oscillator TUNING control.	Meter reading is at maximum.	Readjust tuning controls for maximum meter reading in the following order: T110, T111, T105, T104, T103, T102, and T101 (par. 131).
	24	Second limiter grid current	METER SWITCH in position 3. R-F OUTPUT of test oscillator connected to the ANT. INPUT on the receiver. Output of the oscillator is reduced by detuning the oscillator TUNING control.	Meter reading is at maximum.	Adjust controls on T108 for maximum meter reading (par. 131).
	25	Balance of the discriminator circuit.	R-F OUTPUT of test oscillator connected to ANT. INPUT on receiver. Meter switch in position 4 or 5.	Meter reads 0	See paragraph 131.
	26	Antenna tuning of receiver	Test oscillator disconnected. Receiver cover closed and in carrying case. Antenna connected to ANT. INPUT and communication established with distant station. METER SWITCH in position 1 or 2.	Meter reading is at maximum.	Adjust ANTENNA TUNING control for maximum reading.

Radio Transmitter T–14(*)/TRC–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	27	a. Second doubler grid current (D and E models).	METER SWITCH in position 1. Switch on handset pressed.	Meter reading is greater than .2 ma.	Adjust tuning capacitors C55 and C56 on transformer T11 and C11 and C12 on T1 for maximum meter reading.
		b. Quadrupler grid current (unlettered, A, B, C, and H models).	METER SWITCH in position 1. Switch on handset pressed.	Meter reading is greater than .1 ma.	Adjust tuning capacitor C11 and C12 on transformers T1 for maximum meter reading.
	28	a. Third doubler grid current (D and E models). b. First doubler grid current (unlettered, A, B, C, and H models).	METER SWITCH in position 2. Switch on handset pressed.	Meter reading is .4 to .7 ma.	Adjust tuning capacitor C17 on transformer T2 for maximum meter reading.
	29	a. Fourth doubler grid current (D and E models). b. Second doubler grid current (unlettered, A, B, and H models).	METER SWITCH in position 3. Switch on handset pressed.	Meter reading is about .5 ma.	Adjust tuning capacitor C22 (C68 and C69 in H model) on transformer T3 for maximum meter reading.
	30	a. Fifth doubler grid current (D and E models). b. Third doubler grid current (unlettered, A, B, C, and H models).	METER SWITCH in position 4. Switch on handset pressed.	Meter reading is about 1.3 ma.	Adjust tuning capacitor C27 (C70 and C71 in H model) on transformer T4 for maximum meter reading.
	31	P-a grid current	METER SWITCH in position. Switch on handset pressed.	Meter reads about 1.2 (6.0 ma) or more.	Adjust tuning capacitor C42 for maximum meter reading.
	32	P-a cathode current	METER SWITCH in position 6. Power switch in HIGH position. Switch in handset pressed.	Meter reads 1.65 (165 ma).	See paragraph 130.

172. Equipment Performance Checklist—(Continued)

Amplifier AM–8(*)/TRA–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	33	Power-amplifier grid current.	Handset switch pressed. METER SWITCH S201 in GRID CURRENT position. Amplifier TUNE OPERATE switch in TUNE position. Plate power switch ON.	Meter reads about 18 ma.	See paragraph 130 for transmitter tuning. See paragraph 132 for tuning of amplifier.
	34	Amplifier plate current	Handset switch pressed. Amplifier TUNE OPERATE switch S204 to TUNE position. Plate power switch to ON. METER SWITCH in PLATE CURRENT position. Indicator Sub-assembly MX–970/U connected to amplifier ANTENNA connector. ANTENNA LOADING control at minimum.	Meter reads about 75 ma	Adjust PLATE TUNING for minimum plate current. See paragraph 132 for tuning of amplifier.
	35	Amplifier plate current under full load condition.	Coaxial cable connected from antenna to ANTENNA connector. Handset switch pressed. Amplifier TUNE OPERATE switch in OPERATE position. PLATE power switch to ON. METER SWITCH in PLATE CURRENT position.	Meter reads 270 ma	See paragraph 132 for loading of amplifier.

Radio Receiver R–19(*)/TRC–1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	36	LINE ON-OFF switch	Turn to OFF position.	Receiver POWER ON pilot lamp goes out. Filaments and plate circuits of receiver are deenergized.	

Radio Transmitter T-14(*)/TRC-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	37	Switch in the handle of handset.	Release	Plate power is removed from transmitter.	
	38	LINE ON-OFF switch	Throw to OFF position	The green FILAMENT ON pilot lamp goes out.	

Amplifier AM-8(*)/TRA-1

	Item No.	Item	Action or condition	Normal indications	Corrective measures
STOP	39	Plate ON-OFF switch	Throw to OFF position	Plate power removed from amplifier.	
	40	Filament ON-OFF switch	Turn to OFF position	Filaments and bias supply are deenergized. Green FILAMENT pilot lamp goes out.	

CHAPTER 5
AUXILIARY EQUIPMENT

Section I. TERMINAL EQUIPMENT

173. Telephone Terminal CF–1–(*)

a. Telephone Terminal CF–1–(*) is the principal component of Telephone Terminal Set TC–21–(*). This terminal (fig. 100) provides four telephone channels. Channel 1 is a v-f channel and channels 2, 3, and 4 are v-f channels superimposed on carrier frequencies. The voice frequencies received on channels 2, 3, and 4 are changed to modulated carrier frequencies at the carrier transmitting terminal and are shifted back to voice frequencies at the carrier receiving terminal. The four channels occupy, approximately, the frequency band from 200 to 12,000 cps. During reception, each of the channels is separated from the others by filters. The transmission in one direction uses one pair of the spiral-four cable and the transmission in the other direction uses the other pair. For satisfactory multichannel communication, radio terminal stations should not be more than 5 miles from the carrier terminal. Telephone Terminal Sets TC–21–A and –B are described in TM 11–341.

b. Telephone Terminal CF–1–(*) is transportable and designed for use on spiral-four cable to provide high quality, long distance, tactical signal communications. In wire circuits, it provides a d-c signaling and a d-c telegraph circuit on the two simplexed pairs of the spiral-four cable. (With radio equipments, both wire pairs are used for one phantom Telephone EE–8–(*) circuit. This is spoken of throughout this manual as the "simplex" circuit because the binding post terminals are marked SX on Telephone Terminal CF–1–(*).) One or more of the telephone channels may be used for v-f telegraph. Each telephone channel requires 1,000/20-cycle ringing equipment. Telephone Terminal CF–1–(*) has automatic transfer from the 115-or 230-volt a-c power source to storage battery. It is enclosed in a wooden case with removable front and back covers. Three carrying handles are provided on each side. The binding post panel is located at the top of the rack.

c. This unit requires 61 watts of a-c power. It uses ten type 6SJ7 and two type 6V6 tubes. Carbon blocks and drainage coils at the binding post strip provide lightning protection. Provision is made only for the termination of 4-wire

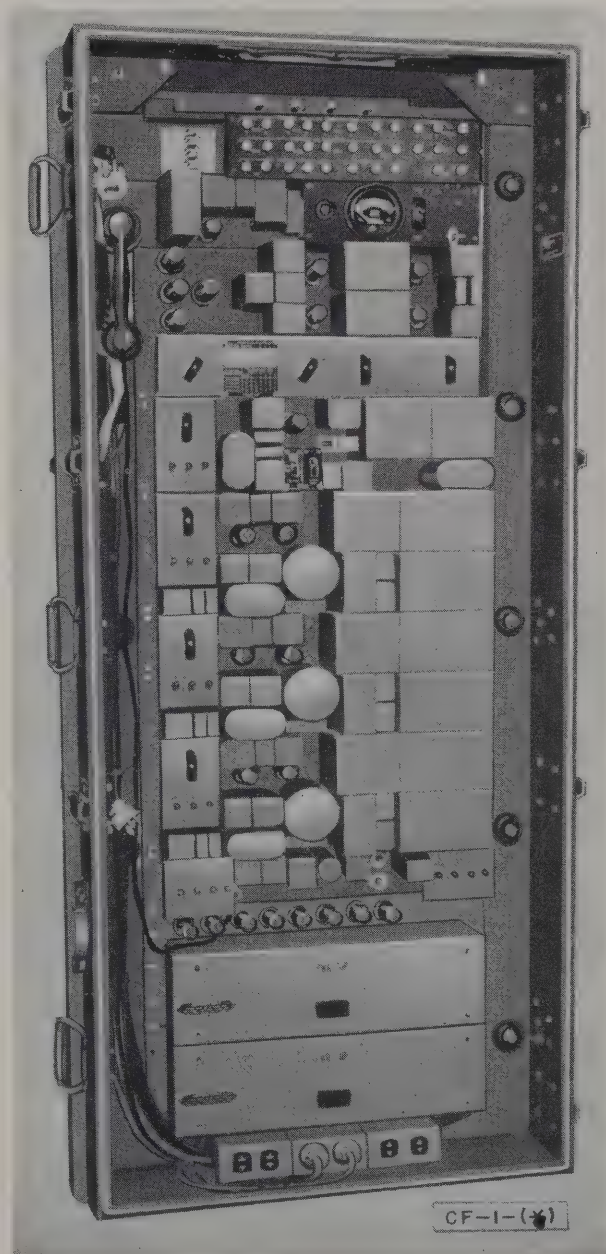


Figure 100. Telephone Terminal CF–1–B.

600-ohm type lines in the A model. A built-in signal generator supplies 1,000-cycle test tone which may be impressed on any channel for line-up purposes and the input level of this tone may be checked by the permanently attached dbm meter. The B model differs from the A model mainly in having all four channels in one bay instead of two and having provision for either 2-wire or 4-wire connection. The B model also has a built-in handset. The unpacked unit weighs 480 pounds; export packed it weighs 740 pounds.

d. Telephone Terminal Set TC–21–(*) includes Test Equipment IE–53 and Tool Equipment TE–123.

174. Repeater CF–3–(*)

a. Repeater CF–3–(*) is a transportable 4-wire carrier repeater designed for use at intermediate points in a spiral-four cable carrier system (fig. 101). This repeater will be used with the radio equipments covered in this technical manual only if the carrier terminal is located more than five miles from the terminal radio station. Repeater CF–3–(*) amplifies simultaneously all transmission present on the physical pairs of a spiral-four cable. It is designed to give two simplex channels for d-c signaling and d-c telegraph. It has built-in transmission testing equipment, a talking and monitoring arrangement for the v-f channel (No. 1), and automatic transfer from a-c power supply to a storage battery in case of a-c power supply failure.

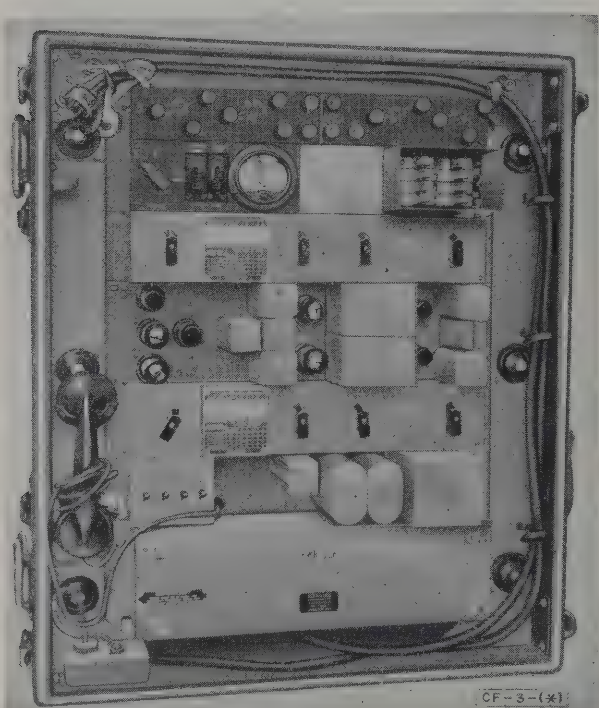


Figure 101. Repeater CF–3–A.

b. The normal output is 0 dbm and the location is normally at 25-mile intervals. Power consumption is 31 watts; two 6SJ7 and two 6V6 tubes are used. Repeater CF–3–(*) and approximately fifty miles (25 miles in each direction) of spiral-four cable are, for most purposes, interchangeable with one Radio Relay Set AN/TRC–4. The radio relay set has less total weight and is not as greatly handicapped by extremely rough terrain or large rivers as the repeater and cable system.

175. Telegraph Terminal CF–2–(*)

This is a transportable, 4-channel carrier telegraph terminal designed for use on any normal telephone channel. It converts d-c teletypewriter signals into an a-f tone. Telegraph Terminal CF–2–(*) uses eight frequencies in the range of 500 to 2,050 cycles, thus using one voice channel for transmitting all four telegraph channels. The telegraph terminal provides two-way transmission, each telegraph channel using two different frequencies for the two directions of transmission. The telegraph terminal is designed for operation over one channel of Telephone Terminal CF–1–(*); usually channel 3 is used (par. 51). The A model is made up of two bays of equipment and has two telegraph channels per bay. The B model (fig. 102) provides four channels in one bay.

176. Ringing Equipments

When a 20-cycle ringing signal is received from a switchboard or a Telephone EE–8–(*), the ringing equipment transmits a 1,000-cycle tone interrupted at approximately 20 cycles to the telephone channel of the carrier equipment. This 1,000/20 cycle tone is converted back to a 20-cycle ringing signal by similar equipment at the other end of the carrier system. The ring-

ing signal is then fed to the corresponding switchboard or Telephone EE–8–(*). Ringing Equipment EE–101–A (fig. 103) is the principal component of Ringer Set TC–24 and has facilities for two v-f telephone channels. Ringing Equipment EE–100–A has provisions for ringing one line. Ringing equipments are covered by TM 11–342.

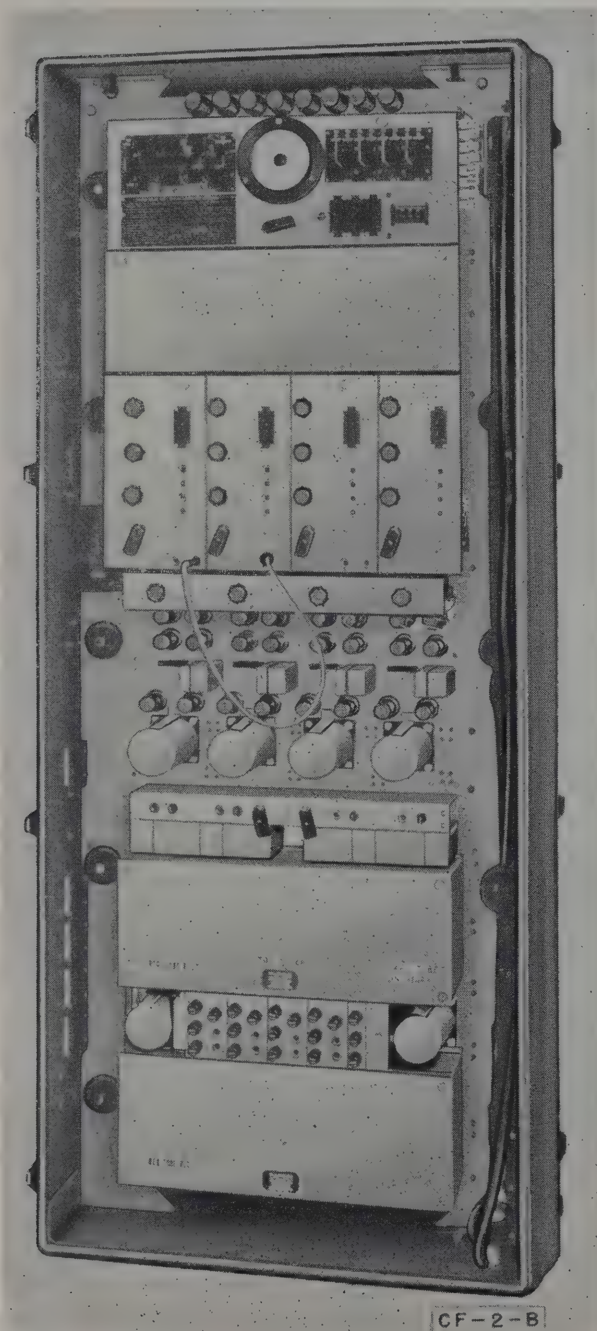


Figure 102. Telegraph Terminal CF–2–B.

177. Telegraph Terminal TH–1/TCC–1

Telegraph Terminal TH–1/TCC–1 is a single-channel carrier telegraph terminal. It derives one carrier telegraph circuit from a telephone circuit while retaining the voice circuit. Separation of speech and telegraph currents is accomplished by band elimination filters which block out about 1,500 to 2,000 cycles for telegraph use. Possible d-c loops are neutral, half-duplex, full-duplex, polarential, or two-path polar. V-f ringing is required on telephone circuits on which this unit is used, and a v-f ringer is part of it. Filter F–2/GG is used at intermediate points to bypass telephone equipment. The carrier is on for MARK and off for SPACE. Telegraph Terminal TH–1/TCC–1 may be stacked with packaged equipments. This unit is used in the teletypewriter communication nets of army, army groups, and of the communication zone of a theater of operations. It weighs 167 pounds unpacked. For further details, refer to TM 11–2206.

178. Facsimile Equipment

a. Facsimile Equipment RC–120–(*). Facsimile Equipment RC–120–(*) is used for transmission and reception of printed, written, drawn, or photographic copy over regular voice communication channels. Copy 7 inches wide by 7⅜ inches long can be transmitted in its original size in 7 minutes. This equipment is described in TM 11–375B. Facsimile Equipment RC–120–(*) is being replaced gradually by Facsimile Sets AN/GXC–2 and AN/GXC–3.

b. Facsimile Equipment AN/TXC–1. Facsimile Equipment AN/TXC–1 is similar to Facsimile Equipment RC–120–(*) except that it transmits a copy up to 12 inches wide by 18 inches long in 20 minutes. It is described in TM 11–2258. Facsimile Equipment AN/TXC–1 is being replaced gradually by Facsimile Transmitting Set AN/TXT–2 and Facsimile Receiving Set AN/TXR–2.

179. Teletypewriter Equipment

a. Teletypewriter Set AN/PGC–1. This is a portable, lightweight, immersion proof teletypewriter set that can be man-packed into forward combat areas. It is used to send and re-

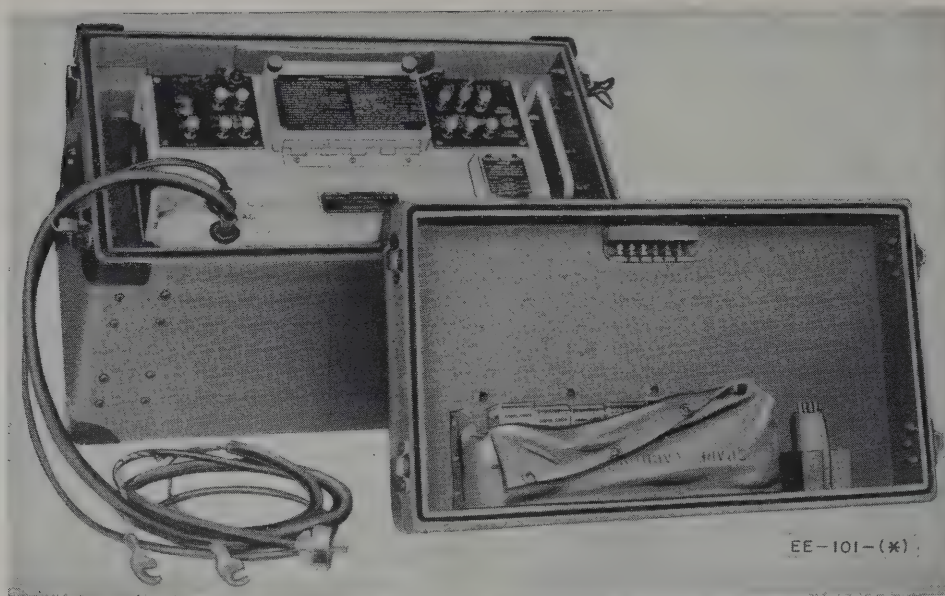


Figure 103. Ringing Equipment EE–101–A.

ceive teletypewriter code signals and to transcribe the signals in the form of page copy. This set is a complete unit that includes a teletypewriter, power unit, tools, and accessories. It is intended to be carried on regular quartermaster packboards, and is used in the tactical teletypewriter nets of infantry divisions and regiments in the forward areas of the combat zone. It weighs 236 lbs. unpacked.

b. Teletypewriter Set AN/TGC–1. This is a combination of teletypewriter equipments housed in a metal console. All power and line connections are accessible from the front; the consoles may be set up side by side, back to back, or against a wall. The set includes a multiple transmitter-distributor, typing reperforators, motor-driven tape winder, rectifier, tape feed-out feature, and necessary controls and alarms. It receives messages in the form of electrical impulses and records the message in code perforations and typewritten form on paper tape. This tape can then be fed to a transmitter-distributor for retransmission to a line circuit or to a page printing teletypewriter. This set speeds up the receiving, transmitting, or relaying of tape teletypewriter messages and normally is used on a single channel, duplex teletypewriter circuit. It may be used for split operation on two duplex circuits. It is used in large fixed-plant, wire or radio, teletypewriter systems of a communications zone of a theater of operations or in the zone of the interior Refer to TM 11–2203.

c. Teletypewriter TG–7–(*). This is a portable field teletypewriter designed to interchange typewritten messages by electrical means between two or more points. It is a page-receiving and keyboard-sending teletypewriter, which is equipped with a standard communication keyboard, type-bar arrangement, pulling magnetic selector, and no line relay. It has a series-governed, a-c motor controlled by switch or automatic built-in control. Teletypewriter TG–7–A is the same as Teletypewriter TG–7–B except that certain minor features, not required in tactical service, have been omitted from the later model. Teletypewriter TG–7–(*) is a component part of Teletypewriter Sets EE–97, EE–97–A, EE–98, EE–98–A and Telegraph Central Office Set TC–3, and is used in the tactical teletypewriter communication nets of divisions, corps, army, and other teletypewriter systems that require teletypewriters of the capabilities of this unit. Refer to TM 11–352.

d. Reperforator-Transmitter TG–26–A. This is an assembly of equipment which consists of a typing perforator, keyboard, tape container, transmitter, and jack box, all mounted together on a common base and equipped with a wooden case-type cover. The cover serves as a

table when this unit is made ready for operation. The unit is the main component of Reperforator Teletypewriter Set TC–16. Reperforator-Transmitter TG–26–A perforates and types messages on tape received from the local keyboard (or from line signals) and sends signals from tape which is run through the tape transmitter. It is particularly adaptable for use at message distribution centers because the perforated tape may be used to retransmit the message to one or more stations by means of the transmitter. Thus, the necessity for manual transmission by direct keyboard or manual preparation of perforated tape is eliminated. The typewritten characters on the tape facilitate identification and distribution of the message type at a message center. This unit is intended for use in the tactical teletypewriter systems of Corps and Army. Refer to TM 11–2201.

e. TELETYPEWRITER TT–4/TG. This is a portable, man-packed, immersion-proof teletypewriter set that can be packed on a regular quartermaster packboard by one man. It is inclosed in a metal case finished in olive drab. It is a page-receiving and keyboard-sending teletypewriter, equipped with a standard communication keyboard, intended for use in the tactical teletypewriter nets of the forward areas of the combat zone. It is a component part of Teletypewriter Set AN/PGC–1, described in *a* above.

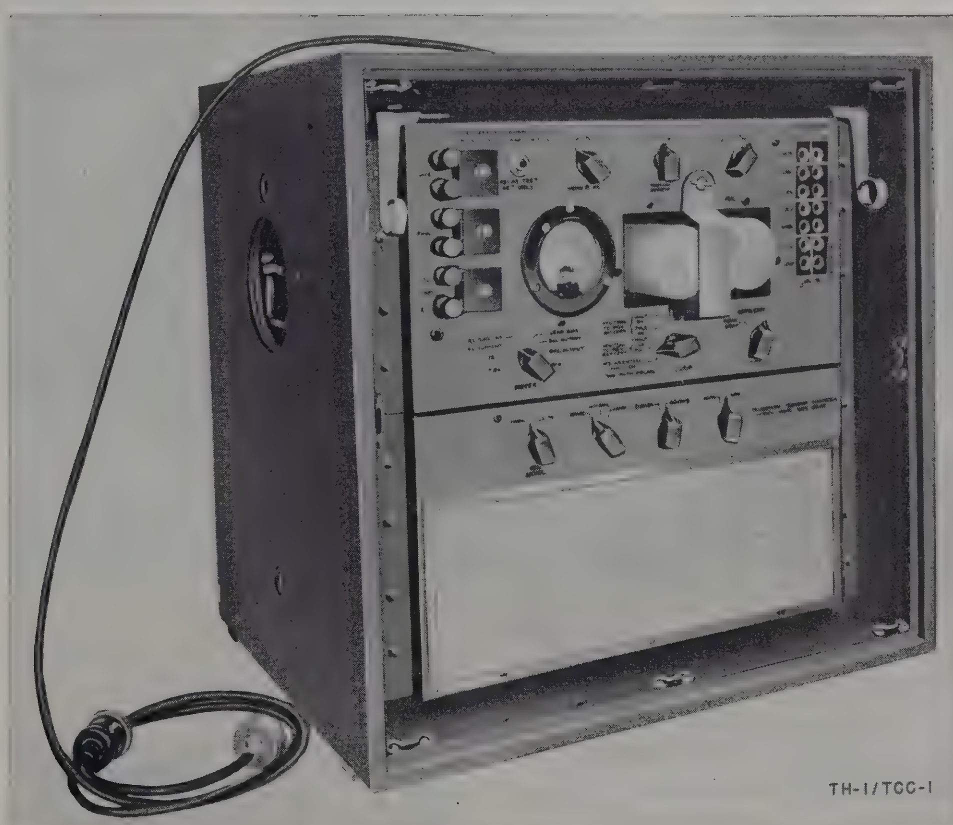


Figure 104. Telegraph Terminal TH–1/TCC–1.

Figure 105. Remote Control Unit C–112/TRA–2.

Section II. REMOTE CONTROL EQUIPMENT AN/TRA–2(*)

180. Description

a. Remote Control Equipment AN/TRA–2(*) provides for the remote control of Radio Set AN/TRC–1(*), Radio Terminal Set AN/TRC–3(*), or Radio Relay Set AN/TRC–4(*). It consists of two separate man-transportable units in individual carrying cases (figs. 105 and 106) and is described in TM 11–2621.

b. Remote Control Unit C–112(*)/TRA–2 (fig. 105) contains—

1 Headset HS–30–(*) equipped with Cord CD–874–(*) and Plug PL–55.

1 Chest Unit H–19(*)/U or Chest Set H–28/GR equipped with cord and Plug PL–68.

1 Microphone T–45 equipped with Cord CD–318–(*).

1 Loudspeaker LS–11 with cord and Plug PL–55.

c. Operating power is supplied by Control Unit C–113(*)/TRA–2 (fig. 106); it may be either 115 volts or 230 volts from a 50- to 60-cycle source. Plug the power cord into one of the outlets of Junction Box JB–110. The power, speech, and control cords attached to the control unit are stored in the case. Three spare fuses and a contact burnisher are attached to the cover.

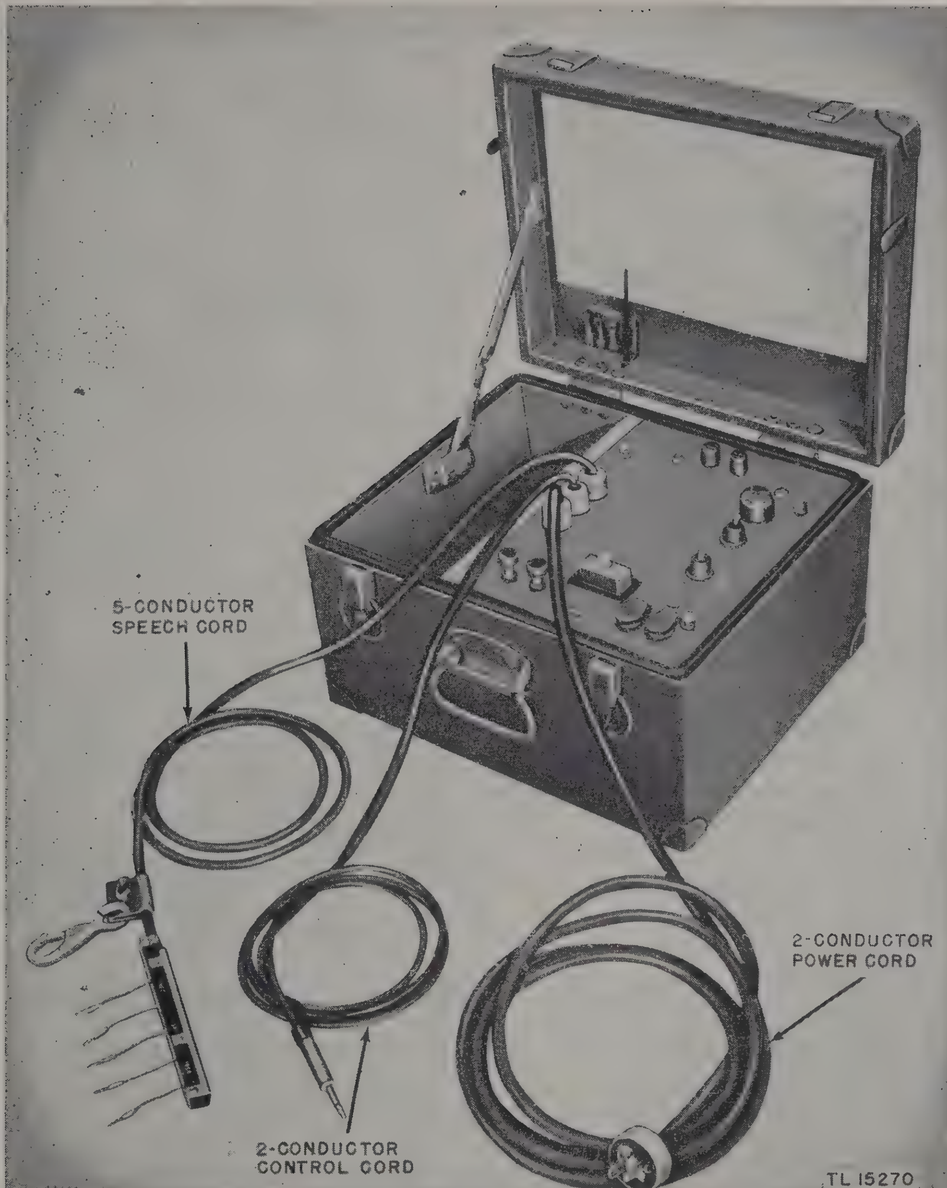


Figure 106. Control Unit C–113/TRA–2.

181. Automatic Relay Operation

a. Connect the equipment as shown in figure 107. Separate the transmitting and receiving antennas by a distance sufficient to prevent reception of spurious transmitter harmonics (sec. V, ch. 4). This distance will depend upon the choice of crystal frequencies. Select the crystals according to the interference charts in paragraph 134.

b. Set LINE SWITCH of Remote Control Unit C–112(*)/TRA–2 to TWO WIRE position.

c. Set Radio Transmitter T–14(*)/TRC–1 controls as follows:

(1) LINE switch to ON position.

(2) CABLE COMPENSATOR to position 8.

(3) CARRIER CONTROL switch to position 2.

d. Set Radio Receiver R–19(*)/TRC–1 controls as follows:

(1) LINE switch to ON position.

(2) SQUELCH switch to ON position and

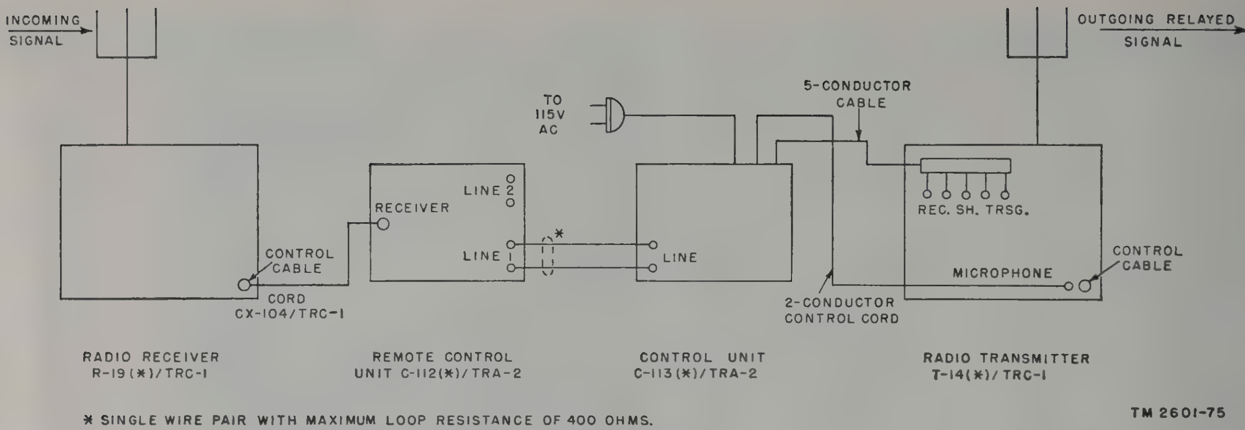


Figure 107. Automatic relay operation, cording diagram.

turn ADJUST control for squelch operation (par. 131*o*).

(3) CHANNEL switch to SINGLE CHANNEL position.

(4) METER SWITCH to position 6.

(5) AUDIO GAIN control to register a reading of plus 1 dbm on the meter during average voice peaks when a voice-modulated signal is being received on channel 1.

182. Two-Wire Radio Remote Control

a. Connect as shown in figure 108.

b. Set LINE SWITCH of Remote Control Unit C–112(*)/TRA–2 to TWO WIRE position.

c. Set Radio Transmitter T-14(*)/TRC–1 controls as follows:

(1) CABLE COMPENSATOR to maximum.

(2) CARRIER CONTROL switch to position 1.

d. Set RADIO Receiver R-19(*)/TRC–1 controls as follows:

(1) AUDIO GAIN to obtain sufficient volume at Remote Control Unit C–112(*)/TRA–2.

(2) METER SWITCH to position 6 only when output level does not exceed plus 6 dbm. Greater output may result in injury to meter.

183. Four-Wire Radio Remote Control

a. Connect the equipments as shown in figure 109.

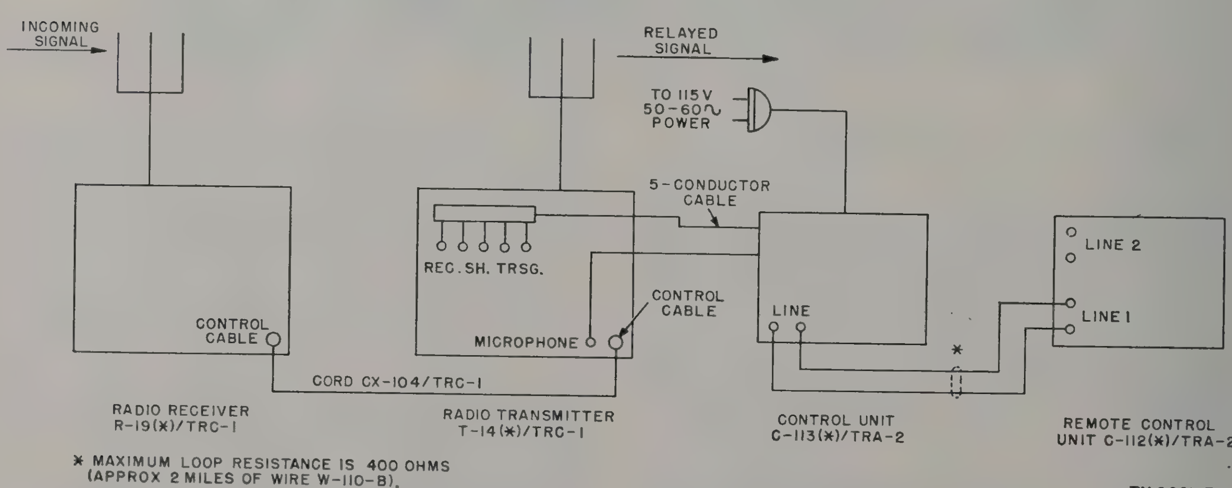


Figure 108. Two-wire radio remote control, cording diagram.

b. Set LINE SWITCH of Remote Control Unit C–112(*)/TRA–2 to FOUR WIRE position.

c. Set Radio Transmitter T–14(*)/TRC–1 controls as follows:

(1) CABLE COMPENSATOR to maximum.

(2) CARRIER CONTROL switch to position 1.

d. Set Radio Receiver R-19(*)/TRC–1 controls as follows:

(1) AUDIO GAIN to obtain sufficient volume at Remote Control Unit C–112(*)/TRA–2.

(2) METER SWITCH to position 6 only when output level does not exceed plus 6 dbm. Greater output may result in injury to meter.

184. Operation

a. GENERAL. Set ON-OFF switch on control unit to ON position; pilot lamp should light. Handset TS–15–(*) or H–23(*)/U is plugged into the MIC and PHONES jacks at the lower right-hand corner of Control Unit C-113(*)/TRA–2. Remote Control Unit C-112(*)/TRA–2 has facilities for plugging in three sets of headsets and microphones. Either Chest Unit H–19(*)/U or Microphone T–45, or both may be used. Normally, Loudspeaker LS–11 is plugged into the LOUDSPEAKER jack. Headsets may be used for two-wire radio remote control (fig. 108) and four-wire radio remote control (fig. 109). The loudspeaker is not generally used for automatic relay operation (fig. 107). Plugging in a headset automatically disconnects the loudspeaker. Check position of LINE SWITCH for proper position to correspond to the particular method of operation. Rotate counterclockwise for installations corresponding to figures 107 and 108 (two-wire service) and clockwise for installations corresponding to figure 109 (four-wire service).

b. OPERATING INSTRUCTIONS FOR CONTROL UNIT C–113(*)/TRA–2.

(1) *Radio Transmission.* Operate switch on Handset TS–15–(*) or H–23(*)/U and hold while talking. The voice will modulate Radio Transmitter T–14(*)/TRC–1 and will also be transmitted by field wire to Remote Control Unit C–112(*)/TRA–2.

(2) *Intercommunication* (figs. 107 and 108). Operate INTERCOM. switch in the direction of the arrow on the panel and hold to prevent modulation of the transmitter. Operate thumb switch on handset and hold only while talking. *Release thumb switch when listening.* Intercommunication feature is not provided for installations corresponding to figure 109 (four-wire service). In an emergency, however, where intercommunication is essential without modulating the transmitter, rotate LINE SWITCH counterclockwise to the TWO WIRE position. Operate as outlined above. Restore LINE SWITCH to FOUR WIRE position when normal operation is resumed.

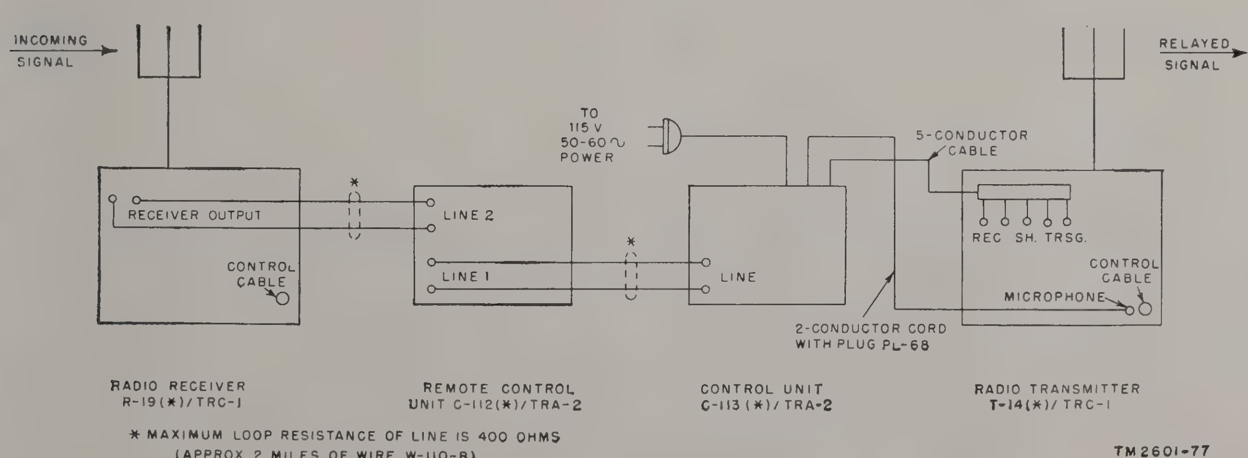


Figure 109. Four-wire radio remote control, cording diagram.

c. Operation of Remote Control Unit C–112(*)/TRA–2.

(1) *Radio Transmission.* Operate push-button switch on Chest Unit H–19(*) /U or cord switch of Microphone T–45 and hold while talking. Release switch of either type microphone to reestablish radio reception. Radio signals will not be received either at Control Unit C–113(*)/TRA–2 or at Remote Control Unit C–112(*)/TRA–2 while microphone switches are held operated.

(2) *Intercommunication* (fig. 107). Operate INTERCOM. switch in the direction of the arrow on the panel and hold when necessary to increase listening level, but only if it *does not* interfere with operation of radio. This switch need not be used on installations corresponding to figure 108. Privacy of intercommunication feature is under the control of the operator at Control Unit C–113(*)/TRA–2 only. If operator at Remote Control Unit C-112(*)/TRA–2 desires that the communication does not modulate the transmitter, he should request the operator at Control Unit C–113(*)/TRA–2 to operate the INTERCOM. switch.

CHAPTER 6
THEORY

Section I. THEORY OF RADIO TRANSMITTER T–14(*)/TRC–1

185. Simplified Block Diagram

a. GENERAL. Radio Transmitter T–14(*)/TRC–1 is an f-m transmitter using the phase-shift method of obtaining frequency deviation of the carrier wave. Its characteristics are considerably different from those of the usual a-m (amplitude-modulated) units. The use of the phase-shift method of frequency modulation permits direct crystal control of the mean carrier frequency, a necessary provision in unattended and mobile equipment. However, this method requires the use of considerable frequency multiplication after the modulator stage in order to obtain sufficient carrier frequency deviation. The frequency multiplier stages use small, low-drain, receiver type tubes, and have a total frequency multiplication of 96. When working with f-m transmitters, there are handicaps that make useless many of the rules which

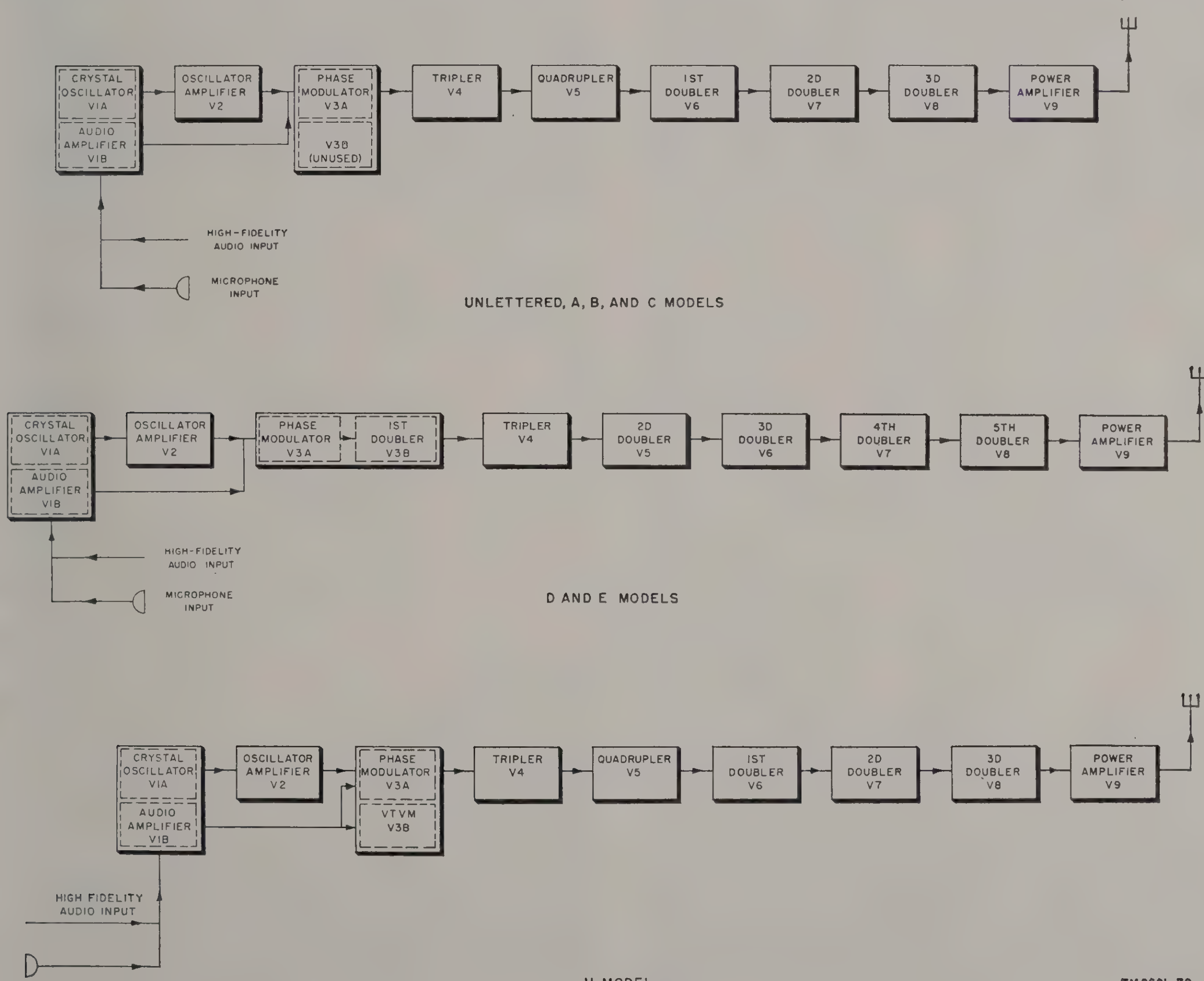


Figure 110. Simplified block diagram of Radio Transmitter T–14(*)/TRC–1.

aid in servicing a-m equipment. Since no change of pattern is observed during modulation, the simpler cathode-ray oscilloscopes are of little value in making tests. In fact, modulation does not result in a readily measured change of any kind in the r-f output of the transmitter.

b. BLOCK DIAGRAM. The relationship between the stages of the transmitter is shown in a block diagram (fig. 110). The output of crystal oscillator tube V1A is amplified in oscillator amplifier tube V2 and applied to phase-modulator tube V3A. A-f voltages from either the local microphone or the high-fidelity input network are amplified in audio-amplifier tube V1B and also impressed on phase-modulator tube V3A (and VTVM tube V3B in the H model). The output of the phase modulator drives tripler tube V4 (in the D and E models, first doubler tube V3B). In the unlettered, A, B, and C models, the second section of tube V3 is not used. In all models of the transmitter, tube V4 is a frequency tripler, which, in turn, drives tube V5. Tube V5 is the second doubler stage in the D and E models and is a frequency quadrupler in the unlettered, A, B, C, and H models. At this point, in all models, the frequency has been multiplied 12 times. Tubes V6, V7, and V8 function as successive doublers in all models, bringing the frequency multiplication up to 96 times that of the crystal frequency. The output of tube V8 drives p-a tube V9; the output of V9 is fed to the antenna through standard coupling circuits.

186. Crystal Oscillator

a. The carrier frequency is accurately controlled by a CT-cut, low-temperature drift, quartz crystal mounted in a crystal holder. Crystal Units CR–4/U are used with late procurements of these sets and will fit all models. The crystal, ground to operate at one ninety-sixths of the carrier frequency, is connected, through capacitor C60 (not in the unlettered through C models) and inductor L1, between the grid and plate of tube V1A. Inductor L1 and capacitor C1 resonate at a frequency midway between the highest and lowest crystal frequency used. This arrangement, in the Pierce type oscillator circuit used, provides the necessary feedback to produce a stable oscillation over a wide range of crystal activity. Resistor R51 has been added in parallel with L1 (in the D, E, and H models) to flatten the peaked resonance curve. This, with the addition of a tuned plate load, gives normal oscillator output throughout the frequency range of the crystal oscillator. Thermostatic switch TD1 keeps the temperature of the crystal oven between 120° and 140°F.

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A, B, C	D, E	H
C1	40	22	22
C5	100	100	100
C54	NOT USED	40	39
C59	NOT USED	5000	4700
C60	NOT USED	5000	4700
R1	350 K	350K	360K
R6	50K	150K	150K
R51	NOT USED	15K	15K
L1	770 UH	770 UH	770 UH
L6	NOT USED	770 UH	770 UH

NOTE:
UNLESS OTHERWISE SHOWN
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

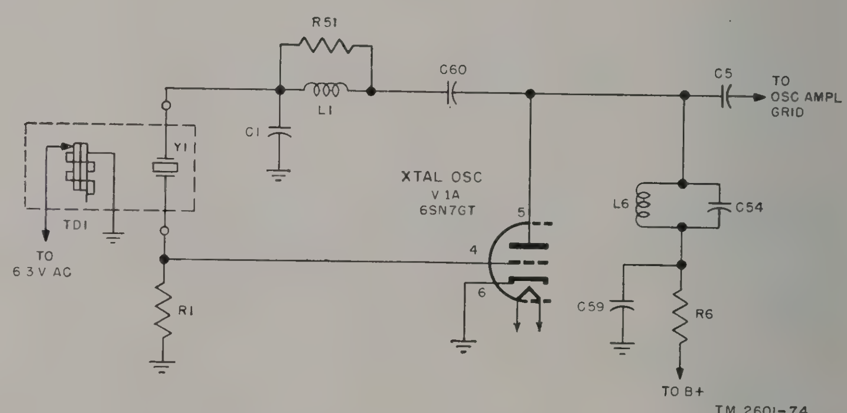


Figure 111. Crystal oscillator stage.

b. Voltage is applied to the plate of tube V1A through resistor R6 and inductor L6. In the unlettered, A, B, and C models, the tuned circuit composed of L6 and C54 is not used, and R6 is the only plate load. The tuned plate load (L6 and C54) has been added to the D, E, and H models in order to eliminate a transmitter dead spot occurring between 83 and 85 mc. In the D, E, and H models resistor R6 and capacitor

C59 decouple the plate r-f circuit from the B+ supply. Capacitor C60 keeps d-c plate voltage off the crystal unit; this capacitor was not used in the unlettered through C models. Rectified grid current flowing through grid-leak resistor R1 provides the necessary grid bias for the tube. The output of this stage is fed to the oscillator-amplifier control grid through capacitor C5.

187. Oscillator Amplifier

a. The output of the crystal oscillator is low and subject to change due to variations in crystal activity and frequency. For this reason, oscillator-amplifier stage V2 (fig. 112) is used. It acts as a limiting amplifier and provides substantially constant output to drive phase-modulator tube V3. The output of crystal-oscillator tube V1 is coupled to the grid of oscillator-amplifier tube V2 by blocking capacitor C5. Tube V2 operates class C and the rectified grid current flowing through grid-bias resistor R10 provides operating bias. R13 is the screen-grid voltage-dropping resistor. Capacitor C7 keeps the screen grid at r-f ground potential. Late H models have a bleeder resistor, R71, connected from the screen to ground, for increasing screen-voltage stability. The plate of tube V2 receives its operating plate voltage through plate load resistor R12.

b. The output developed across resistor R12 is coupled to the phase-modulator grid through d-c blocking capacitor C8. In the H model, low-pass filter T11 has been added between plate load R12 and the plate. Its purpose is to filter out all unwanted harmonics that would otherwise be in the oscillator amplifier output. These harmonics would be radiated by the transmitter wiring and cause interference in adjacent receivers. Filament choke L8 has been added to some procurements of the H model to reduce further any harmonic radiation.

188. Phase Modulator

a. The output of oscillator-amplifier tube V2, on the crystal frequency, is impressed on the grid of phase-modulator tube V3A (fig. 113) by means of d-c blocking capacitor C8. There are two paths by which r-f energy may reach plate load inductance L2 of the phase modulator. The first path is directly through the grid-to-plate interelectrode capacity of the vacuum tube represented as C_{gp} on the diagram. The second path is due to the transconductance (GM) of tube V3A. Because of the two paths, there are two voltages on the plate of tube V3A which are nearly 180° out of phase. Normally, because of the high transconductance of the tube, the voltage component due to the transconductance would be much larger. In this case, however, it is reduced to approximately the same magnitude as the direct capacity feed-through voltage component by means of de-

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A, B, C	D, E	H
C5	100	100	100
C7	1500	1500	1500
C8	50	50	51
C63	NOT USED	NOT USED	10
C64	NOT USED	NOT USED	10
C65	NOT USED	NOT USED	22
R10	100K	100K	100K
R12	10K	10K	22K
R13	250K	250K	240K
R56	NOT USED	NOT USED	27K
R58	NOT USED	NOT USED	27K
R71	NOT USED	NOT USED	100K

L8 AND R71 USED IN SOME H MODELS.

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

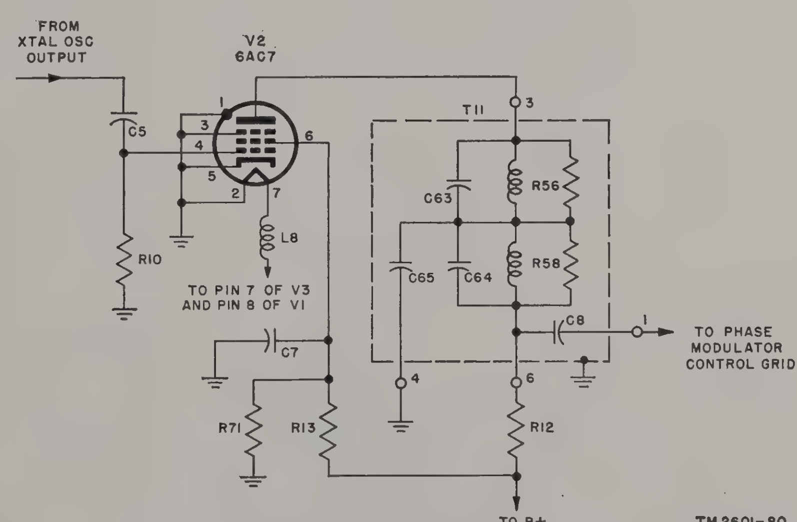


Figure 112. Oscillator amplifier stage.

generative cathode resistor R14. The vector diagram shown in figure 114 illustrates the relative positions and values of the components of plate voltage on tube V3A.

b. When audio voltage is applied to the grid of tube V3A through isolation resistors R9 and R11, the transconductance of V3A is varied at an audio rate. As the transconductance changes, the plate voltage varies as shown in figure 114. These vector diagrams illustrate how this change causes a positive or negative phase shift in the resultant plate voltage at an audio rate. This shifting of phase of the resulting plate voltage and current of phase-modulator tube V3A takes place in synchronism with the a-f modulating voltage and is known as *phase modulation,* a form of frequency modulation.

c. Considerable amplitude change is also present in the resultant plate voltage. This is eliminated by the limiting action of the class C multiplier stages in the transmitter.

d. Audio signals from tube V1B are coupled to the grid circuit of phase-modulator tube V3A through blocking capacitor C4. Resistor R8 and isolation resistors R9 and R11 make up the grid leak for the grid of phase-modulator tube V3A. Plate voltage is applied through plate load inductor L2 (in the H model, also through R53 and R54). Blocking capacitor C9 couples the phase modulator to frequency-tripler tube V4. Capacitor C6 is for preemphasis of the lower frequencies. Resistor R57 (H model only) has been added in series with C6 to give greater linearity in the *preemphasis* circuit. Preemphasis circuits increase the relative strength of higher audio frequencies in a gradual manner to insure that these frequencies will override h-f noise. The relative values of the original audio frequencies are restored at the receiver by deemphasis circuits.

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED	A,B,C,D,E	H
C4	.05 UF	.05 UF	.05 UF
C6	5,000	5,000	5,100
C8	50	50	51
C9	1,500	1,500	1,500
L2	5MH	5MH	5MH
R8	250K	250K	240K
R9	250K	200K	200K
R11	50K	50K	51K
R14	30K	30K	30K
R53	NOT USED	NOT USED	10K
R54	NOT USED	NOT USED	6,800
R57	NOT USED	NOT USED	3,000

NOTES:
1. L8 USED IN SOME H MODELS
2. UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS
CAPACITORS ARE IN UUF.

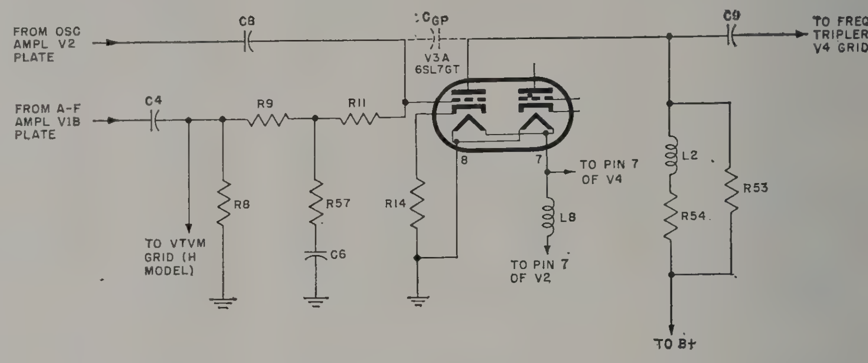


Figure 113. Phase modulator stage.

189. Frequency Multiplication

The frequency deviation which can be produced in the phase-modulator circuit described in paragraph 188 is relatively small when low distortion is desired. To obtain a satisfactory amount of frequency deviation (±30 kc), it is necessary that the frequency of the modulated wave be multiplied considerably. The original deviated frequency in Radio Transmitter T–14(*)/TRC–1 is multiplied by a factor of 96. In D and E models this is accomplished by a doubler which is followed by a tripler and four more doublers. In unlettered, A, B, C, and H models, this is accomplished by frequency tripler tube V4, frequency-quadrupler tube V5, and three frequency-doubler tubes, V6, V7, and

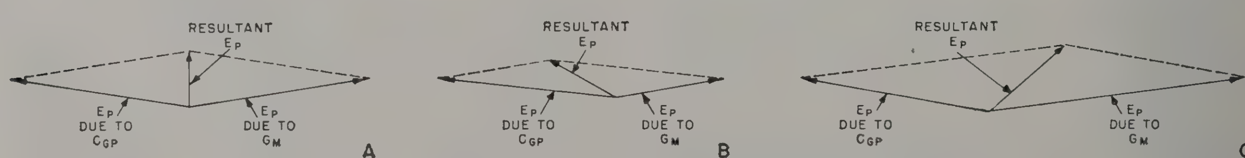


Figure 114. Vector diagram of r-f voltage across phase-modulator load.

V8. All five tubes act as class C r-f amplifiers with grid-leak bias. The grid drive in each case is well above saturation so that slight changes in tuning or reduction in tube emission will have little effect on the succeeding stages. All stages use receiving type tubes, working at relatively low plate and filament currents.

a. First Doubler (D and E Models Only). The second section of tube V3 is not used in the unlettered, A, B, and C models (figs. 184 and 185). In the D and E models, tube V3B is used as the first doubler (fig. 115). The output of the phase-modulator circuit (tube V3A) is fed to the grid of the frequency-doubler section (V3B) through blocking capacitor C9. The rectified grid current flowing through grid-bias resistor R15 provides operating bias. The output of V3B is coupled to the tripler through double-tuned transformer T11. Plate voltage for the first doubler is obtained through the primary of T11. Capacitor C58 is a plate circuit bypass. Both windings of transformer T11 are tuned to twice the frequency of the crystal oscillator, by capacitors C55 and C56, respectively. D-c blocking capacitor C57 couples the output of V3B to the frequency tripler grid.

b. Frequency Tripler (All Models). Tube V4 is the frequency tripler in all models of Radio Transmitter T–14(*)/TRC–1 (fig. 116). In the D and E models, the output from the secondary of transformer T11 is coupled to the grid of tube V4 by blocking capacitor C57. In the unlettered, A, B, C, and H models, the grid of the frequency tripler is fed from

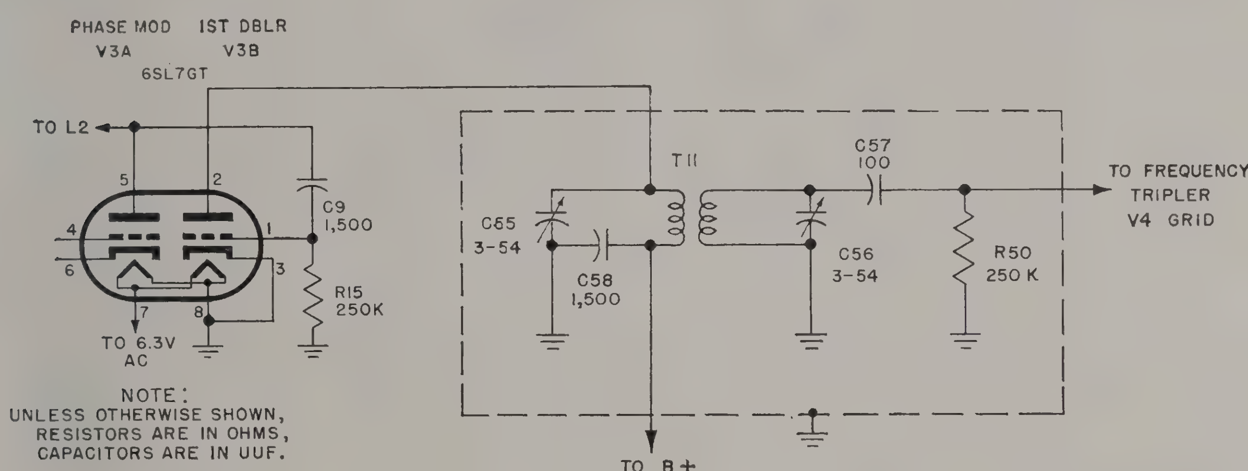


Figure 115. First doubler stage in the D and E models.

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A, B, C	D, E	H
C9	1,500	NOT USED	1,500
C10	1,500	1,500	1,500
C11	3-54	3-54	3-54
C12	3-54	3-54	3-54
C13	100	100	100
C14	1,500	1,500	1,500
C57	NOT USED	100	NOT USED
R15	250K	NOT USED	240K
R16	100K	100K	100K
R50	NOT USED	250K	NOT USED
R52	NOT USED	NOT USED	2K

L9 USED IN SOME H MODELS.
C9 IS THE IST DOUBLER GRID COUPLING CAPACITOR, AND R15 IS THE IST DOUBLER GRID RESISTOR IN THE D AND E MODELS.

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

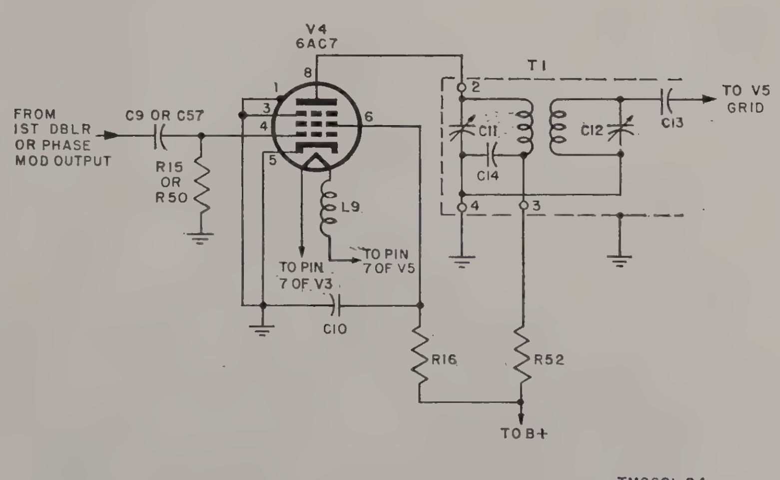
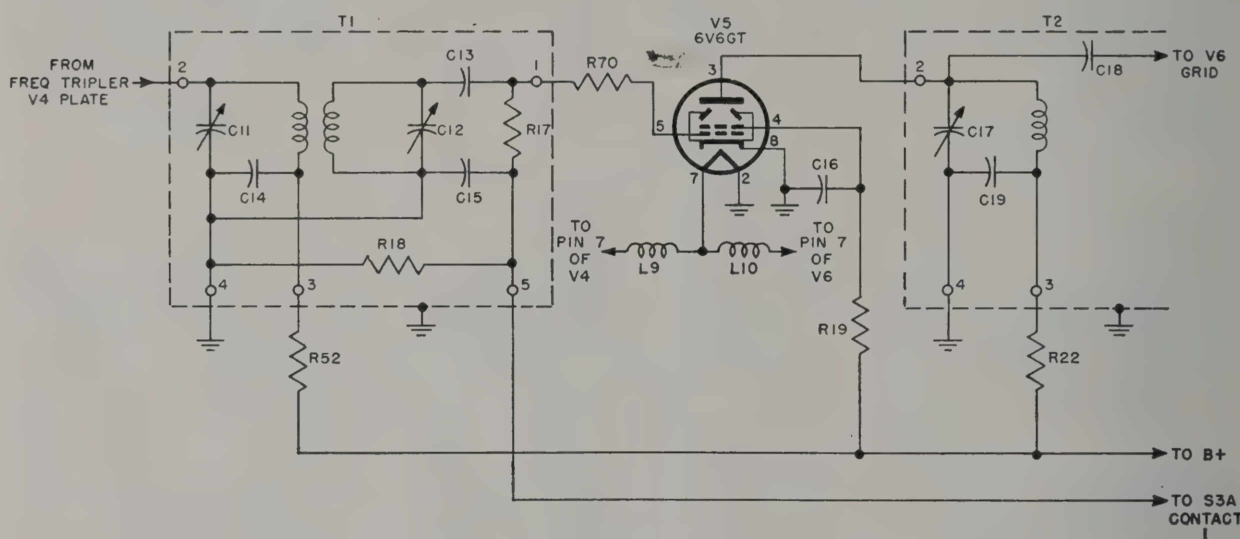


Figure 116. Frequency tripler stage.

the phase modulator output through d-c blocking capacitor C9. The rectified grid current flowing through grid-bias resistor R15 (R50 in the D and E models) provides operating bias. R16 is the screen-grid voltage-dropping resistor. Capacitor C10 bypasses the screen grid to ground. The plate of the primary inductor in r-f transformer T1 is tuned to resonance by trimmer capacitor C11. Capacitor C14 bypasses the plate circuit to ground. In the H model resistor R52 has been added to the plate circuit for additional decoupling. Some H models have inductor L9 added to the filament circuit to lower harmonic radiation.

c. Second Doubler (D and E Models): Quadrupler (Unlettered, A, B, and H Models). Tube V5 is used as a second frequency doubler in D and E models of Radio Transmitter R–14(*)/TRC–1 and as a frequency quadrupler in the unlettered, A, B, C, and H models (fig. 117). The secondary of r-f transformer T1 is tuned to resonance at six (D and E models) or three (unlettered A, B, C, and H models) times the crystal frequency by trimmer capacitor C12. The r-f voltage developed is coupled to the control grid of V5 by d-c blocking capacitor C13. The rectified grid current flowing through grid-bias resistor R17 provides operating bias.



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A,B,C	D,E	H
C11	3-54	3-54	3-54
C12	3-54	3-54	3-54
C13	100	100	100
C14	1,500	1,500	1,500
C15	1,500	1,500	1,500
C16	1,500	1,500	1,500
C17	3-54	3-54	3-54
C18	100	100	100
C19	1,500	1,500	1,500
R17	250K	50K	270K
R18	1K	1K	1K
R19	500K	500K	510K
R52	NOT USED	NOT USED	2K
R70	NOT USED	NOT USED	15

L9, L10, AND R70 USED IN SOME H MODELS.

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

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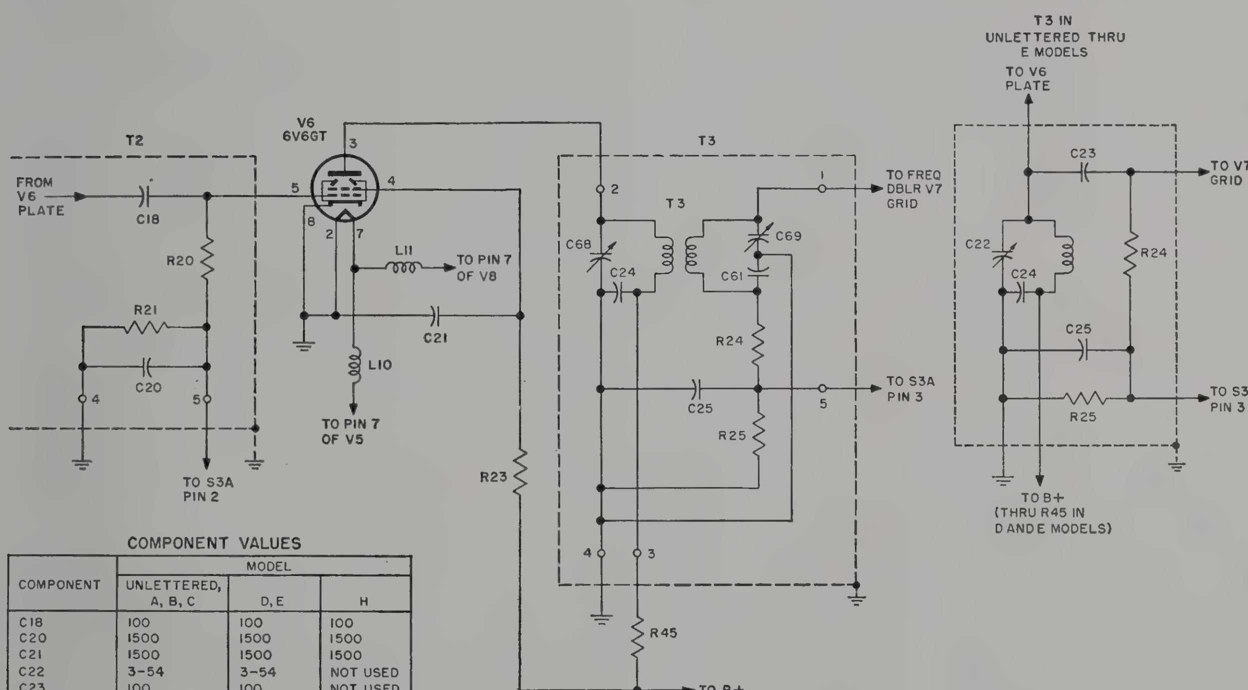
Figure 117. Second frequency doubler, D and E models; frequency quadrupler in unlettered, A, B, C, and H models.

The value of V5 grid current is measured by the front panel meter when the METER SWITCH is in position 1 (fig. 126). Resistor R18 acts as a meter shunt and capacitor C15 acts as a meter r-f bypass. R19 is the screen-grid voltage-dropping resistor. Capacitor C16 bypasses the screen grid to ground. The plate of tube V5 receives its operating plate voltage through inductor T2. T2 is resonated at 12 times the crystal frequency (in all models) by trimmer capacitor C17. Capacitor C19 bypasses the r-f plate circuit to ground, and resistor R22 acts as an isolating and decoupling resistor to prevent r-f voltages from getting into the plate supply. Capacitor C18 couples the output voltage developed across the T2 inductor to the

d. THIRD DOUBLER (D AND E MODELS); FIRST DOUBLER (UNLETTERED, A, B, C, AND H MODELS). Tube V6 functions as a frequency doubler in all models of Radio Transmitter T–14(*)/TRC–1 (fig. 118). The output voltage developed across inductor T2 is coupled to the grid of tube V6 by d-c blocking capacitor C18. The rectified grid current flowing through grid-bias resistor R20 provides operating bias. The value of this current is measured by the meter on the front panel when the METER SWITCH is in position 2 (fig. 126). Resistor R21 acts as a meter shunt and capacitor C20 acts as a meter r-f bypass. Resistor R23 is the screen-grid voltage-dropping resistor. Capacitor C21 bypasses the screen grid to ground. The plate of tube



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A, B, C	D, E	H
C18	100	100	100
C20	1500	1500	1500
C21	1500	1500	1500
C22	3–54	3–54	NOT USED
C23	100	100	NOT USED
C24	1500	1500	1500
C25	1500	1500	1500
C61	NOT USED	NOT USED	1500
C68	NOT USED	NOT USED	3–54
C69	NOT USED	NOT USED	3–54
R20	250K	250K	270K
R21	1K	1K	1K
R23	250K	250K	240K
R24	150K	150K	47K
R25	1K	1K	1K
R45	NOT USED	2K	1800

L10 AND L11 USED IN SOME H MODELS.

NOTE:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

TM 2601–88

Figure 118. First doubler in unlettered, A, B, C, and H models; third doubler in D and E models.

control grid of V6. Resistor R70 is used in the late H models to suppress any parasitic oscillations in the V5 grid circuit. Some H models have inductors L9 and L10 added to the filament circuit to lower harmonic radiation.

V6 receives its operating plate voltage through inductor T3, tuned to resonance at 24 times the crystal frequency by trimmer capacitor C22. In the H model, a double-tuned transformer is used for T3. This double-tuned unit has both

the primary and secondary windings resonated at 24 times the crystal frequency. Bypass capacitor C24 completes the r-f circuit to ground. Resistor R45 is used in the D, E, and H models, in series with the plate supply for additional plate circuit decoupling.

e. FOURTH DOUBLER (D AND E MODELS); SECOND DOUBLER (UNLETTERED, A, B, C, AND H MODELS). Tube V7 functions as a frequency doubler in all models of the transmitter (fig. 119). The output voltage developed across the inductor in r-f transformer T3 (unlettered through E models, fig. 118) is coupled to the grid of tube V7 by blocking capacitor C23 (by the secondary of T3 in the H model). The H model uses double-tuned transformer T4 for coupling between the second and third frequency doublers. The rectified grid current flowing through grid-bias resistor R24 provides operating bias. The value of this current is measured by the panel meter when METER SWITCH S3 is in position 3 (fig. 126). Resistor R25 acts as a meter shunt and capacitor C25 acts as a meter r-f bypass. R26 is the screen-grid voltage dropping resistor. Capacitor C26 bypasses the screen grid to ground. The plate of tube V7 receives its operating voltage through T4, tuned to resonance at 48 times the crystal frequency by trimmer capacitor C27 (C70 in the H model). Bypass capacitor C29 completes the r-f circuit to ground. Resistor R55, in the H model, provides additional plate circuit decoupling. All tubes in the transmitter described up to this point receive their plate and screen voltages from a high-voltage bus supplied from the main plate supply through voltage-dropping resistor R33 (figs. 184 through 187) and bypassed for audio voltages by capacitor C44 and for r-f voltages by capacitor C45 (par. 195).

f. FIFTH DOUBLER (D AND E MODELS); THIRD DOUBLER (UNLETTERED, A, B, C, AND H MODELS). Tube V8 functions as a frequency doubler in all models of the transmitter (fig. 120). The output voltage developed across inductor T4 is coupled to the grid of tube V8 by d-c blocking capacitor C28 in the unlettered through E models. In late H models, coupling between the second and third frequency doubler is accomplished by means of double-tuned transformer T4. The rectified grid current flowing through grid-bias resistor R27 provides operating bias. The value of this current is measured by the front panel meter when the METER SWITCH is in position 4 (fig. 126). Resistor R28 acts as a meter shunt and capacitor C30 acts as a meter r-f bypass. R29 is the screen-grid voltage-dropping resistor. Capacitor C31 bypasses the screen grid to ground. The plate of tube V8 receives its operating voltage through the primary of r-f transformer T5 in the unlettered through E models. Late H models have the V8 plate shunt-fed through L7. D-c blocking capacitor C75 prevents the plate voltage from shorting to ground through the T5 primary (in the shunt-fed models). T5 is tuned to resonance at 96 times the crystal frequency by trimmer capacitor C32. Bypass capacitor C33 (in the unlettered through E models) completes the r-f circuit to ground. Plate and screen voltages are obtained from the B+ supply through decoupling resistor R32 which is bypassed for r-f voltages by capacitor C34. Plate circuit decoupling resistor R66 was used in early H models.

190. Power Amplifier

a. A functional diagram of the power amplifier circuit is given in figure 121. Tube V9 is a dual beam-power tetrode, operated as a push-pull class C amplifier. The push-pull r-f voltage developed in the untuned secondary of r-f transformer T5, is applied to the two control grids of tube V9 by grid coupling capacitors C36 and C37. The rectified grid current from each half of tube V9, flowing through grid-leak resistors R30 and R31, provides independent biasing for each section in order to balance any inequalities in driving voltages. In unlettered, A, B, and C models, meter shunt resistor R34 is connected to ground. In the D, E, and H models, fixed bias is supplied by resistor R49. Resistor R49 is bypassed by capacitor C53 and is located in the center-tap lead from power transformer T8 (fig. 127). All the plate and screen currents in these three models flow through R49; the resulting voltage drop gives a minimum bias to the V9 grids. The value of the combined V9 grid currents is measured by the panel meter when the METER SWITCH is in position 5 (fig. 126). Resistor R34 acts as a meter shunt and capacitor C35 acts as a meter

COMPONENT VALUES

COMPONENT	MODEL: UNLETTERED, A,B,C	MODEL: D,E	MODEL: H
C25	1500	1500	1500
C26	1500	1500	1500
C27	3-54	3-54	NOT USED
C28	100	100	NOT USED
C29	4000	4000	3900
C30	1500	1500	1500
C61	NOT USED	NOT USED	1500
C62	NOT USED	NOT USED	1500
C69	NOT USED	NOT USED	3-54
C70	NOT USED	NOT USED	3-54
C71	NOT USED	NOT USED	3-54
R24	150 K	150 K	47 K
R25	1 K	1 K	1 K
R26	75 K	75 K	75 K
R27	50 K	50 K	47 K
R28	1 K	1 K	1 K
R45	NOT USED	2 K	1800
R55	NOT USED	NOT USED	1 K

L11 USED IN SOME H MODELS

NOTE:
UNLESS OTHERWISE SHOWN·
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF

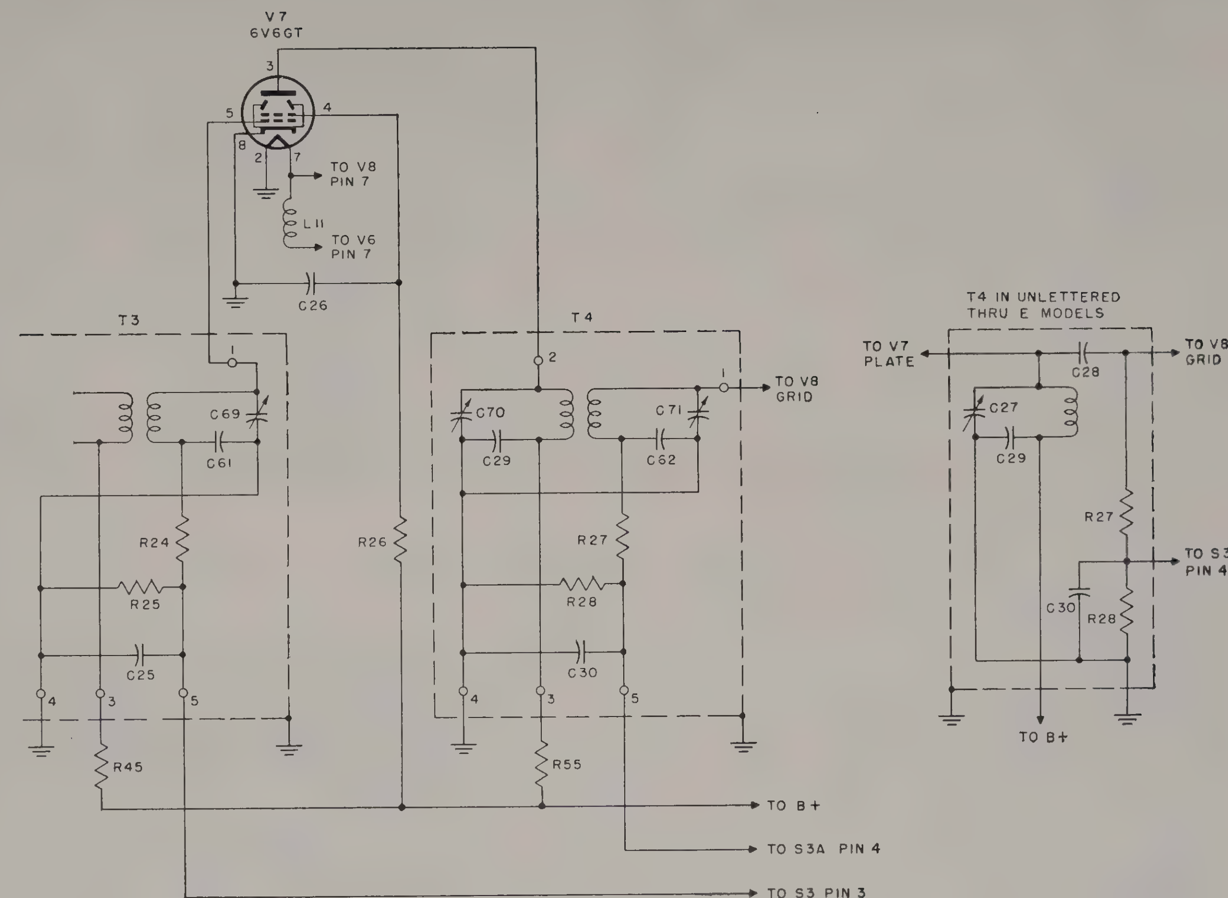
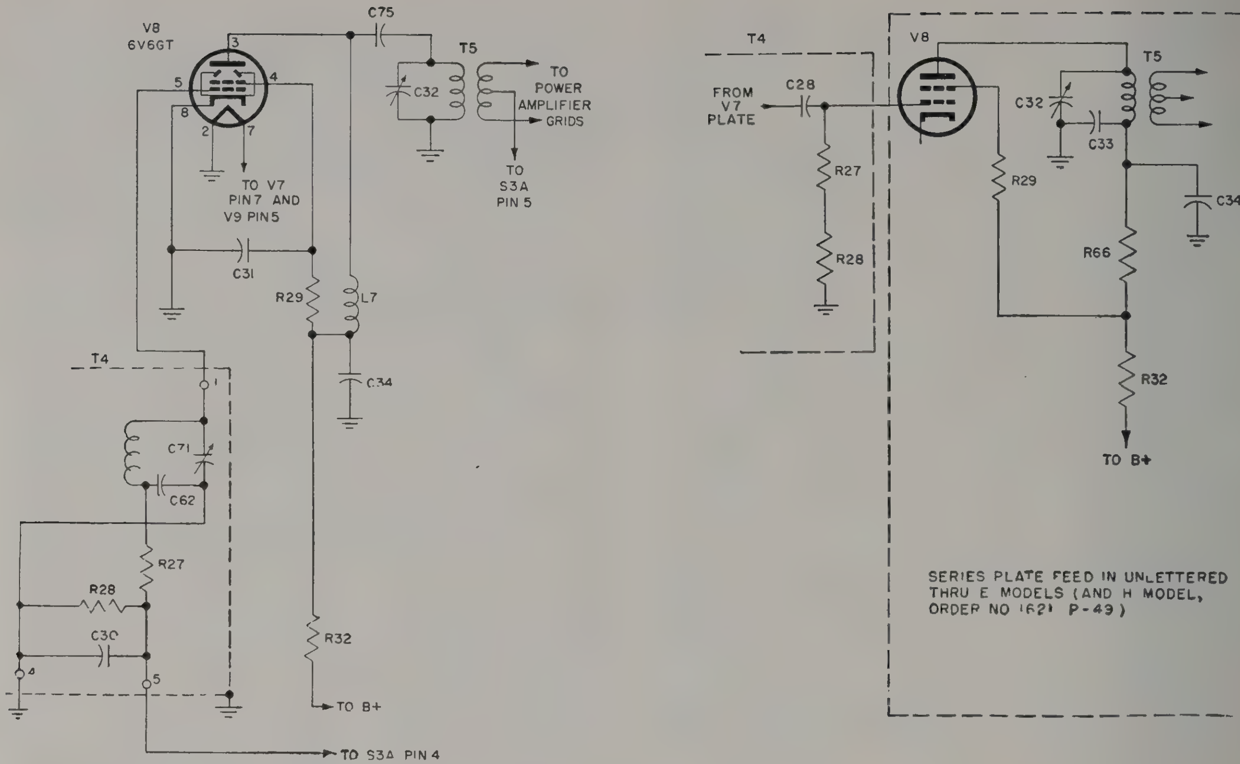


Figure 119. Second doubler in unlettered, A, B, C, and H models; fourth doubler in D and E models.



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED. A,B,C.D.E	H ORDER NO. 1621-P-49	H OTHER ORDERS
C28	100	NOT USED	NOT USED
C30	1500	1500	1500
C31	1500	1500	1500
C32	3-54	3-54	3-54
C33	4000	3900	NOT USED
C34	.01UF	5100	8200
C62	NOT USED	1500	1500
C71	NOT USED	3-54	3-54
C75	NOT USED	NOT USED	200
R27	50K	47K	47K
R28	1K	1K	1K
R29	25K	24K	68K
R32	4K	4K	4K
R66	NOT USED	560	NOT USED

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF

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Figure 120. Third doubler in unlettered, A, B, C, and H models; fifth doubler in D and E models.

r-f bypass. Capacitor C38 acts as a cathode bypass and capacitor C52 keeps the cathode at the same r-f potential as the filament center tap. The d-c cathode circuit is completed to ground by fuse F1 and meter shunt R35 in the unlettered through E models. In the H models, fuse F1 is not used. Capacitor C40, the P. A. TUNING control, resonates plate tank L3.

b. When the METER SWITCH is in position 6 (fig. 126), the panel meter is connected across R35 and measures cathode current in tube V9. R36 and R37 are screen-grid dropping resistors. Both resistors, in series, provide a low screen-grid voltage when the POWER HIGH LOW switch is in the LOW position. When the POWER HIGH LOW switch is in the HIGH position, resistor R36 is shorted out, increasing the screen-grid voltage to its normal operating value. Resistor R33 also drops the applied voltage to the screen (and the V1 through V7 plate and screen voltages). Capacitor C39 bypasses the screen grids to ground. The plates of tube V9 receive their operating voltage through tank inductor L3 which is tuned to resonance at the output frequency by split-stator, ungrounded-rotor, tuning capacitor C40.

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED A,B,C	D,E	H
C35	4000	4000	3900
C36	1500	1500	1500
C37	1500	1500	1500
C38	4000	4000	3900
C39	4000	4000	3900
C40	DUAL 3-35	DUAL 3-35	DUAL 3-35
C41	3-54	3-54	3-54
C42	25	25	24
C45	4000	4000	3900
C52	4000	4000	3900
C53	NOT USED	.01UF	.01UF
F1	.25A	.25A	NOT USED
R30	10 K	5 K	5100
R31	10 K	5 K	5100
R33	4 K	4 K	4 K
R34	12.5	8 333	12 5
R35	.5	.3366	.5
R36	200 K	200 K	200 K
R37	15 K	3500	3100
R49	NOT USED	75	80

R49 IS 75 OHMS IN EARLY H MODELS.

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

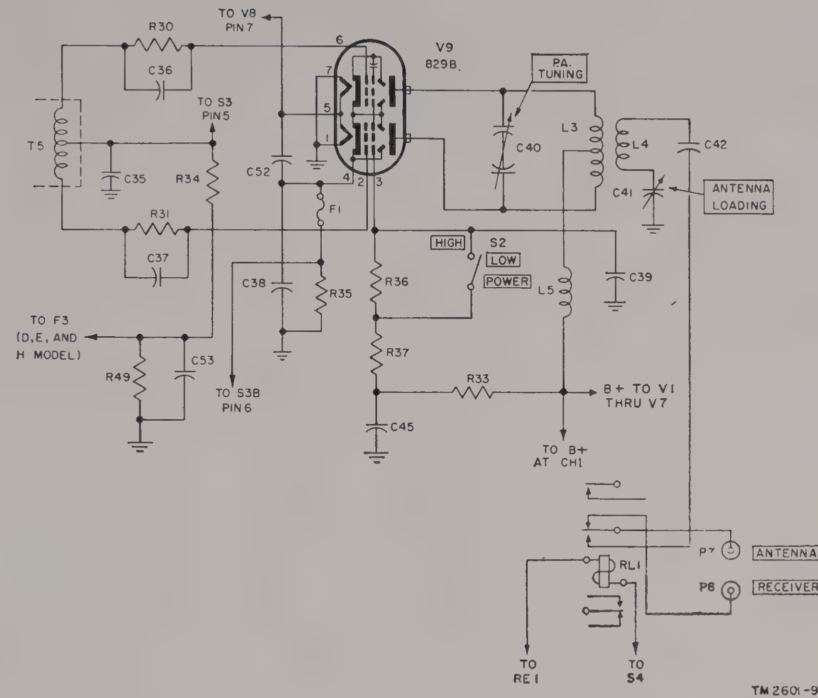


Figure 121. Power amplifier stage.

R-f choke L5 prevents r-f voltages from feeding back into the power supply circuit.

c. The antenna (load) is inductively coupled to tank coil L3 by means of inductor L4. The inductive reactance in the coil, wiring, and antenna-transfer relay circuits is balanced out by fixed capacitor C42 and variable capacitor C41. Capacitor C41 acts as the ANTENNA LOADING adjustment. Operation (closing) of relay RL1 connects transmitter output coil L4 to ANTENNA plug P7 (par. 196).

191. Audio Circuits

Functional diagrams of the audio circuits are given in figure 122. Two separate audio-input circuits are provided for handling the various modes of operation that may be required of Radio Transmitter T–14(*)/TRC–1.

a. High Fidelity Input.

(1) The circuit available at the TRSG. input binding posts (which are located at the top left of the front panel) is intended to operate from a 500-ohm line, such as one pair of the spiral-four cable. Step-up transformer T6 matches the impedance from the line to the grid of V1B, which acts as an audio amplifier. CABLE COMPENSATOR R4 is used to adjust the gain of the audio amplifier to compensate for attenuation in various lengths of telephone line or cable. Potentiometer R44 (not used in the unlettered model), has a screw driver adjustment, which is set at the factory to insure proper percentage of modulation for each carrier channel. With the CABLE COMPENSATOR control in its minimum position (0 on the dial), proper modulation is obtained with normal a-f line level when the radio set is near a multichannel Telephone Terminal CF–1–(*) or Telephone Repeater CF–3–(*).

(2) Since four conversations are transmitted simultaneously under MULTICHANNEL operation, each channel should use only 25 percent of the modulation capability of the transmitter. However, since peak voice levels are not likely to occur on all channels at the same time, each channel is allowed a peak modulation of 30 percent of the total (±30 kc) deviation capability of the transmitter. This amounts to ±9

kc. The normal output level of the carrier telephone equipment is 0 dbm (.001 watt) per channel. The transmitter is adjusted to give a 9-kc deviation per channel, with 0 dbm input per channel and the CABLE COMPENSATOR control at 0.

(3) With an appreciable length of wire line or spiral-four cable between the carrier telephone terminal and Radio Transmitter T–14(*)/TRC–1, the losses occurring in the line or cable may be compensated for by advancing the CABLE COMPENSATOR control. The amount of gain necessary in dbm is estimated, in the case of spiral-four cable, from the fact that the average loss per mile is .8 db. The CABLE COMPENSATOR is calibrated in db and is set at the dial marking corresponding to the estimated line loss.

(4) In unlettered models, fixed resistors R3 and R5 are connected in series with each end of CABLE COMPENSATOR R4 across input transformer T6; potentiometer R44 is not used. In the B model, the T6 primary was loaded with resistors R46 and R48 to match the input properly to a 500-ohm line.

b. Microphone Input.

(1) The second audio-input circuit (fig. 123) is designed to operate from a 30- to 50-ohm single-button carbon microphone, which is contained in Handset H–23(*)/U or Microphone T–45. Either microphone is operated locally and is plugged into jack J1 on the lower right of the transmitter front panel. A 25-ma microphone current is supplied by selenium rectifier RE1, and filtered by means of the double filter network consisting of C50, C51, R40, and R41 (A, fig. 123). Models B, C, D, and E (A and C, fig. 123) have an additional resistor (R47) across capacitor C51 to ground, to eliminate clicks caused by depressing the microphone press-to-talk switch. Resistor R41 is replaced by choke CH2 in the D, E, and H models (C, fig. 123). The H model (B, fig. 123) shunts the d-c microphone current around the primary of transformer T10 by means of resistor R68; the dc is prevented from shorting to ground through the transformer primary by capacitor C73. Better audio characteristics are obtained when the transformer core is not saturated with d-c flux. Some unlettered through C models have been modified by an MWO to correspond with the circuit shown in (C, fig. 123).

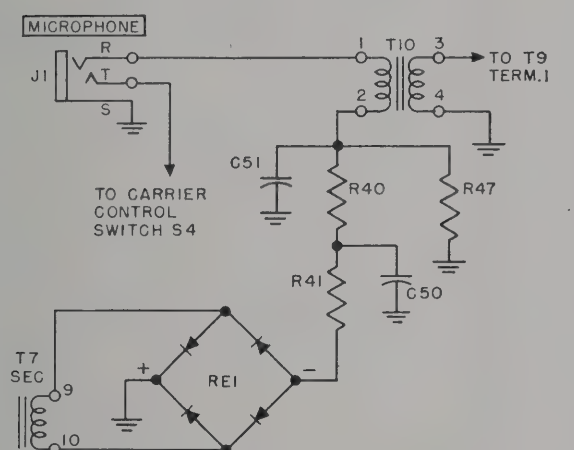
(2) The microphone output is stepped up to a 500-ohm level in transformer T10 and fed through low-pass filter T9 (fig. 122) to remove frequencies above 3,000 cps which might interfere with carrier channels 2, 3, and 4 (channels 2, 3, and 4 operate on audio frequencies above 3,000 cycles). In the unlettered through E models, the output of filter T9 is applied to the grid of audio amplifier V1B in series with the output of audio input transformer T6. In the H model, transformer T12 raises the 500-ohm output level of T9 to 10,000 ohms. This high impedance is a closer match to the input of V1B. R38 and R39 have their resistance raised correspondingly in the H model. Signals from both the high-fidelity (T6) and microphone inputs may be transmitted simultaneously in all models.

(3) The output of the microphone channel is adjusted to modulate the transmitter either 30 percent or 100 percent, according to the position of the CARRIER CONTROL switch. This is accomplished by taking the a-f voltage either across R38 and R39 or just across R39. These resistors are so proportioned that the total voltage across them is sufficient to modulate the transmitter 100 percent. The voltage appearing at the junction of the two resistors is sufficient to modulate the transmitter 30 percent when the local microphone is used for speaking on channel 1 of the four audio circuits. The unlettered through E models of the transmitter have CARRIER CONTROL switch S4 connected so that

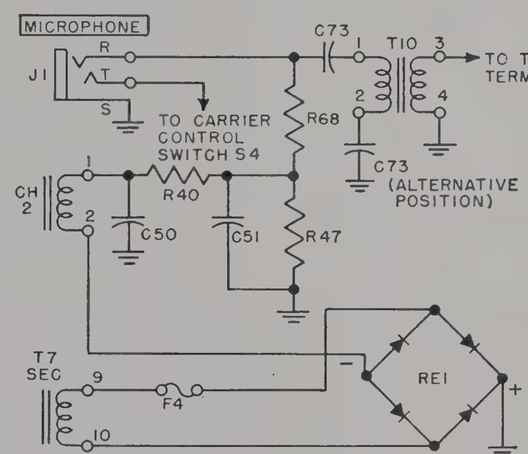
positions 3 and 4 cause 30 percent modulation of the transmitter by the microphone channel. In the H model, positions 1, 2, and 3 of switch S4B allow 100 percent modulation (full deviation) of the transmitter. Thirty percent modulation is used only in position 4 of the H model.

(4) By introducing the local microphone output in series with the high-fidelity input, the local microphone modulation level is unaffected by the position of calibrating potentiometer R44 or CABLE COMPENSATOR R4.

c. AUDIO AMPLIFIER. The second triode section of the dual-triode tube V1 is used as an audio amplifier to raise the audio input voltages to a level sufficient to drive phase-modulator tube V3. R2 is the cathode self-biasing resistor and is bypassed for audio frequencies by capacitor C3. The plate of tube V1B receives its operating plate voltages through plate-load resistor R7 (and decoupling resistor R59 in the H model). Capacitor C2 is an r-f bypass to keep r-f voltages (from the phase modulator) out of the audio amplifier circuits. Blocking capacitor C4 couples the output of the audio amplifier to the frequency-correcting network, which is between the audio amplifier and the phase modulator.



A. UNLETTERED THROUGH C MODEL MICROPHONE INPUTS.

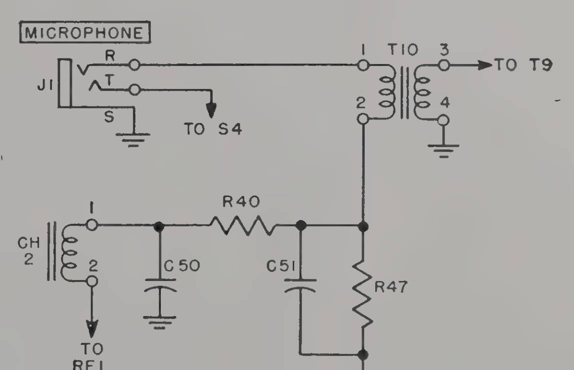


B. H MODEL MICROPHONE INPUT.

COMPONENT VALUES

COMPONENT	MODEL			
	UNLETTERED A,C	B	D,E	H
C50	25UF	25UF	25UF	25UF
C51	25UF	25UF	25UF	25UF
C73	NOT USED	NOT USED	NOT USED	1UF
CH2	NOT USED	NOT USED	5H	4.7H
F4	NOT USED	NOT USED	NOT USED	.25A
R40	500	500	500	100
R41	500	500	NOT USED	NOT USED
R47	NOT USED	500	500	510
R68	NOT USED	NOT USED	NOT USED	100

CH2 IS 6H IN MODIFIED MODELS
C73 IS .25UF IN EARLY H MODELS.



C. MICROPHONE INPUTS IN D AND E MODELS (ALSO UNLETTERED THROUGH C MODELS MODIFIED BY MWO).

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

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Figure 123. Microphone input circuits.

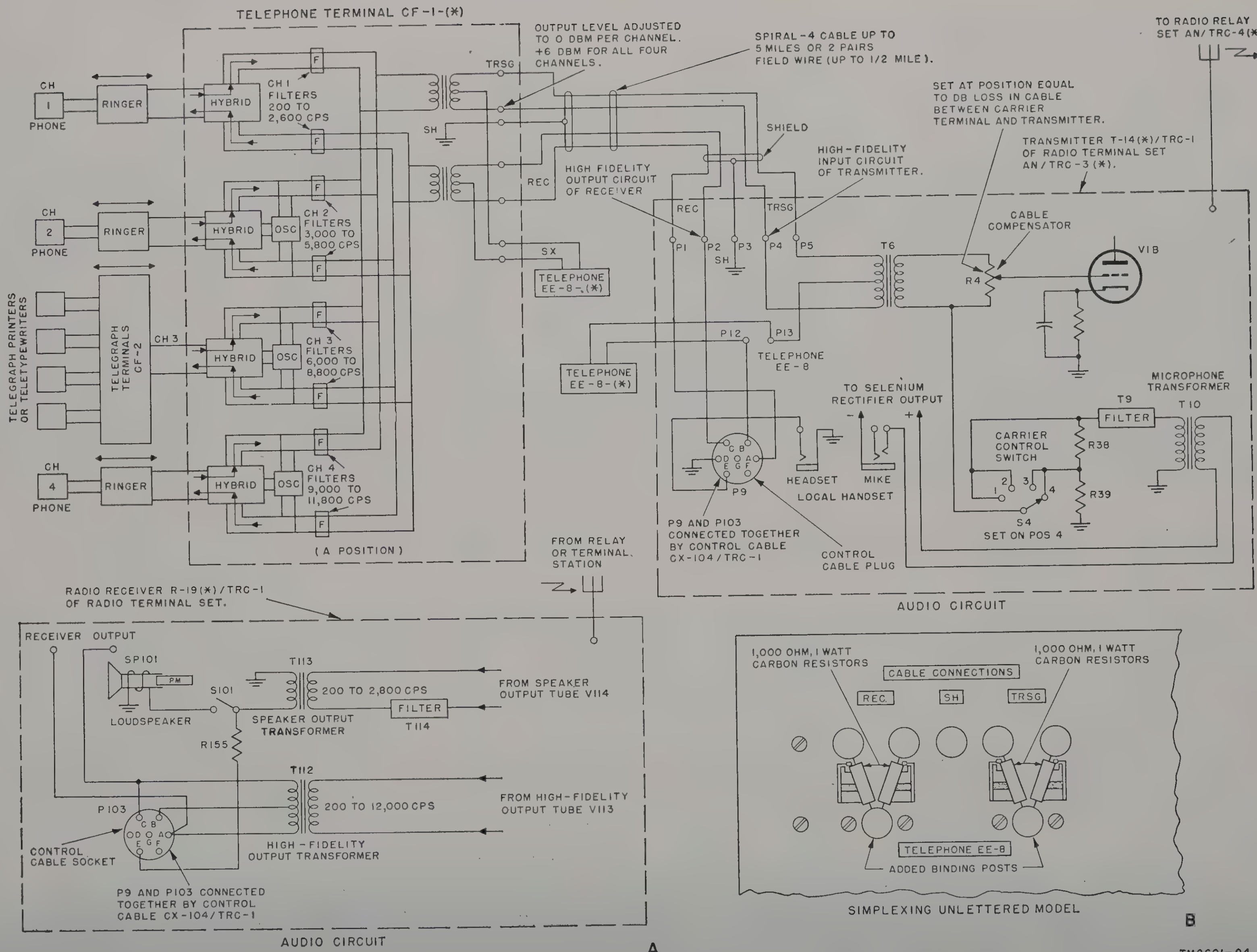
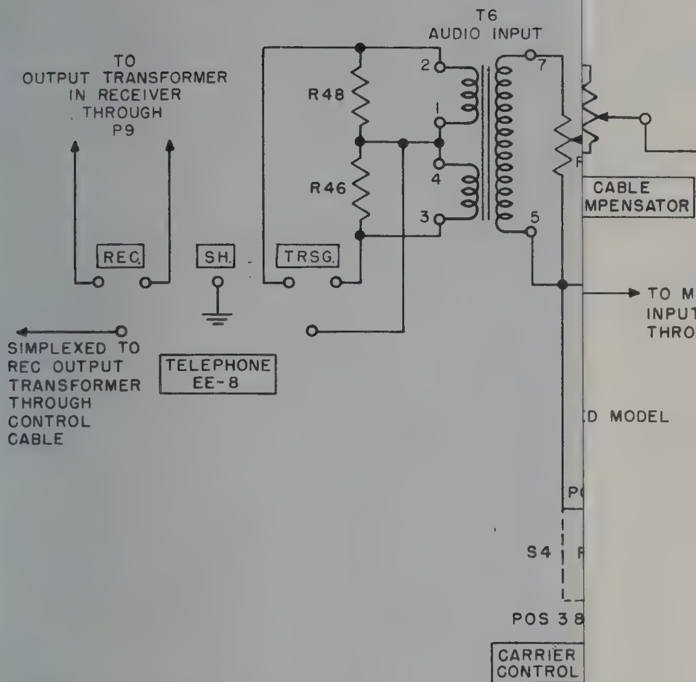
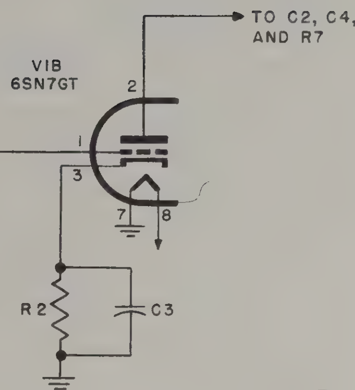


Figure 124. Simplified schematic of audio and telephone simplexing circuits.



MODELS A THROUGH E



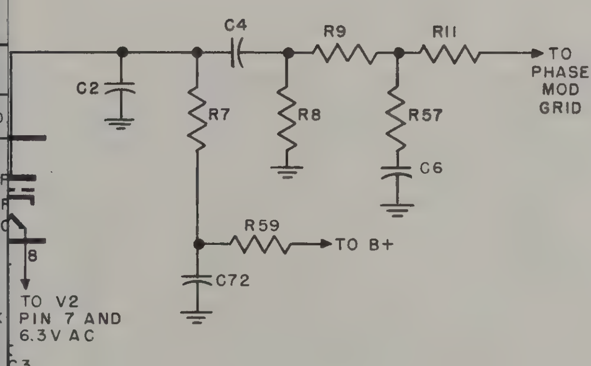
B

COMPONENT VALUES

COMPONENT	MODEL			
	UNLETTERED	A,C	B	D
C2	500	500	500	500
C3	25UF	25UF	25UF	25U
C4	.05UF	.05UF	.05UF	.05U
C6	5000	5000	5000	500
C72	NOT USED	NOT USED	NOT USED	NOT
R2	2K	2K	2K	2K
R3	30K	NOT USED	NOT USED	NOT
R4	25K	100K	100K	100K
R5	10K	NOT USED	NOT USED	NOT
R7	50K	50K	50K	50K
R8	250K	250K	250K	250K
R9	250K	200K	200K	200K
R11	50K	50K	50K	50K
R38	300	300	300	300
R39	200	200	200	200
R44	NOT USED	100K	100K	100K
R46	NOT USED	NOT USED	560	NOT
R48	NOT USED	NOT USED	560	NOT
R57	NOT USED	NOT USED	NOT USED	NOT
R59	NOT USED	NOT USED	NOT USED	NOT

R57 IS 2200 IN EARLY H MODELS

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF,



C

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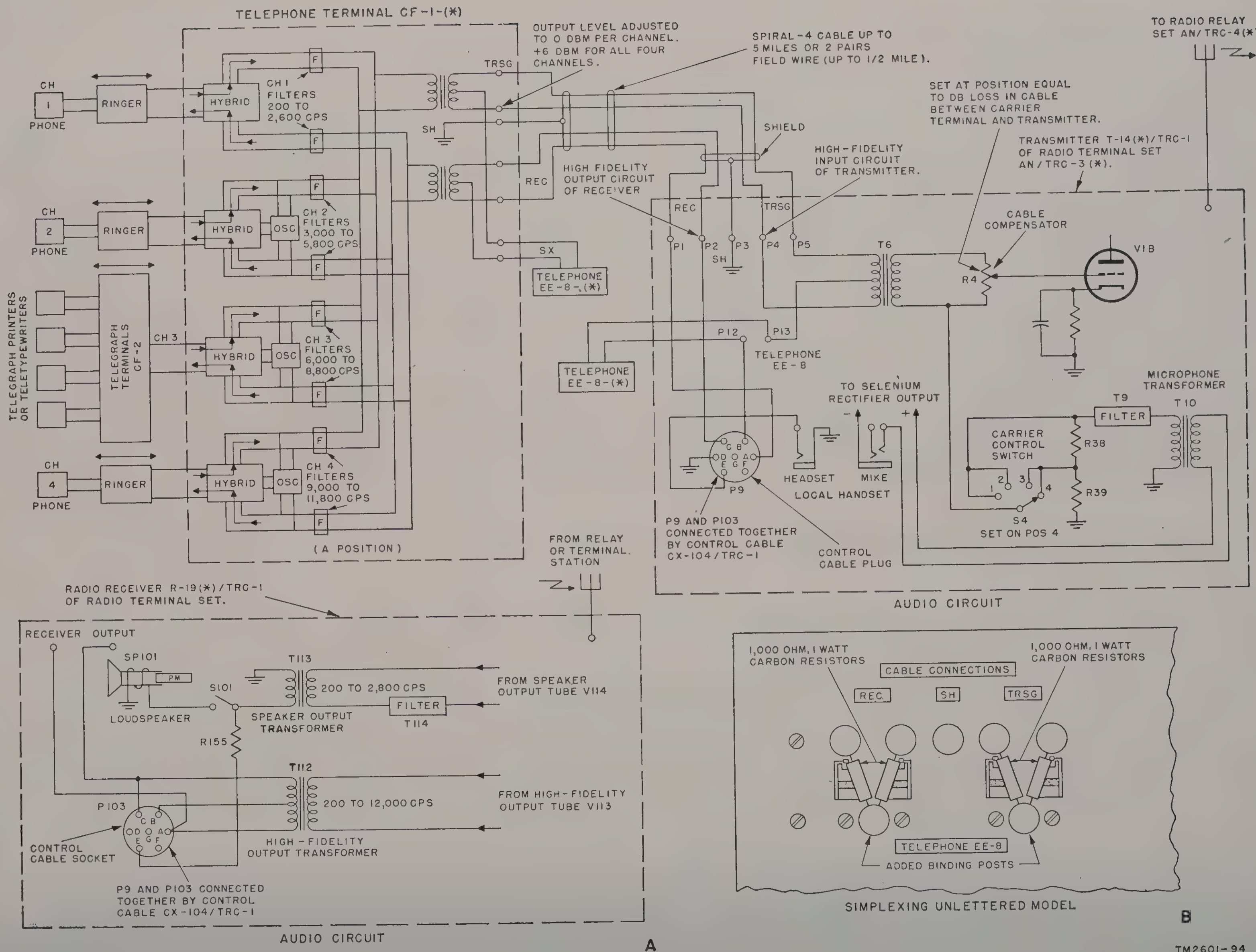
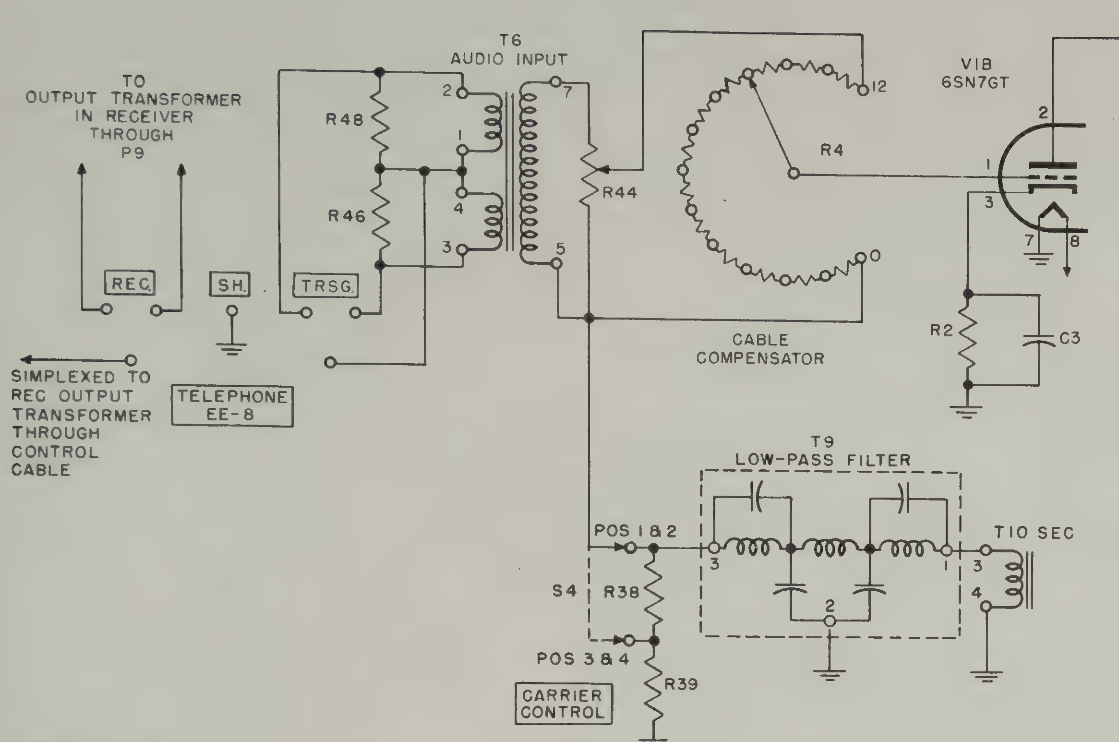
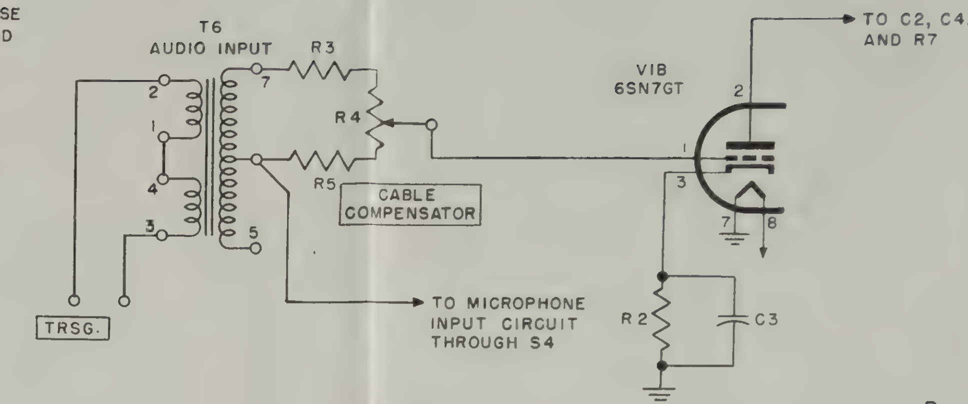


Figure 124. Simplified schematic of audio and telephone simplexing circuits.



MODELS A THROUGH E

A



AUDIO INPUT IN UNLETTERED MODEL

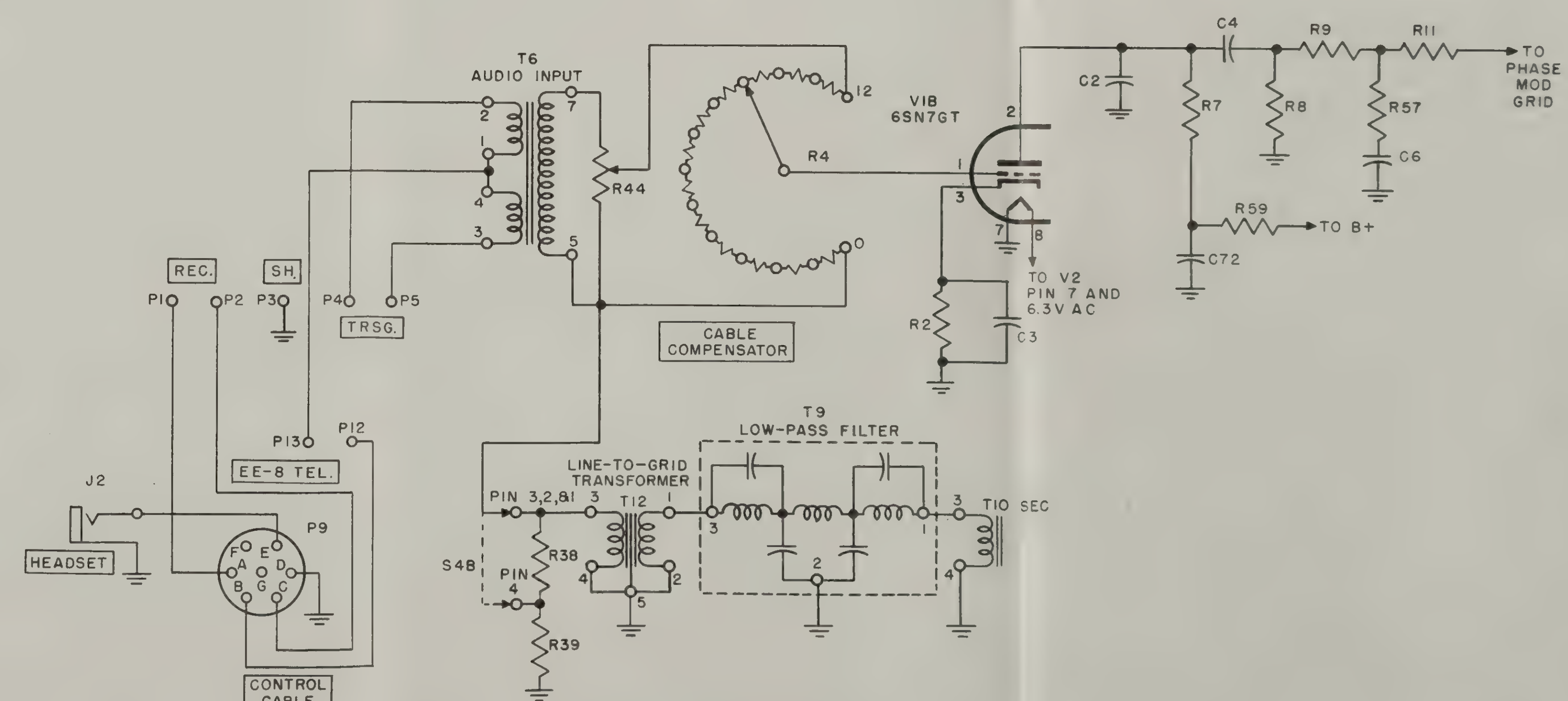
B

COMPONENT VALUES

COMPONENT	MODEL				
	UNLETTERED	A,C	B	D,E	H
C2	500	500	500	500	470
C3	25UF	25UF	25UF	25UF	25UF
C4	.05UF	.05UF	.05UF	.05UF	.05UF
C6	5000	5000	5000	5000	5100
C72	NOT USED	NOT USED	NOT USED	NOT USED	.25UF
R2	2K	2K	2K	2K	2K
R3	30K	NOT USED	NOT USED	NOT USED	NOT USED
R4	25K	100K	100K	100K	100K
R5	10K	NOT USED	NOT USED	NOT USED	NOT USED
R7	50K	50K	50K	50K	56K
R8	250K	250K	250K	250K	240K
R9	250K	200K	200K	200K	200K
R11	50K	50K	50K	50K	51K
R38	300	300	300	300	5600
R39	200	200	200	200	3900
R44	NOT USED	100K	100K	100K	100K
R46	NOT USED	NOT USED	560	NOT USED	NOT USED
R48	NOT USED	NOT USED	560	NOT USED	NOT USED
R57	NOT USED	NOT USED	NOT USED	NOT USED	3K
R59	NOT USED	NOT USED	NOT USED	NOT USED	18K

R57 IS 2200 IN EARLY H MODELS

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF,



H MODEL

C

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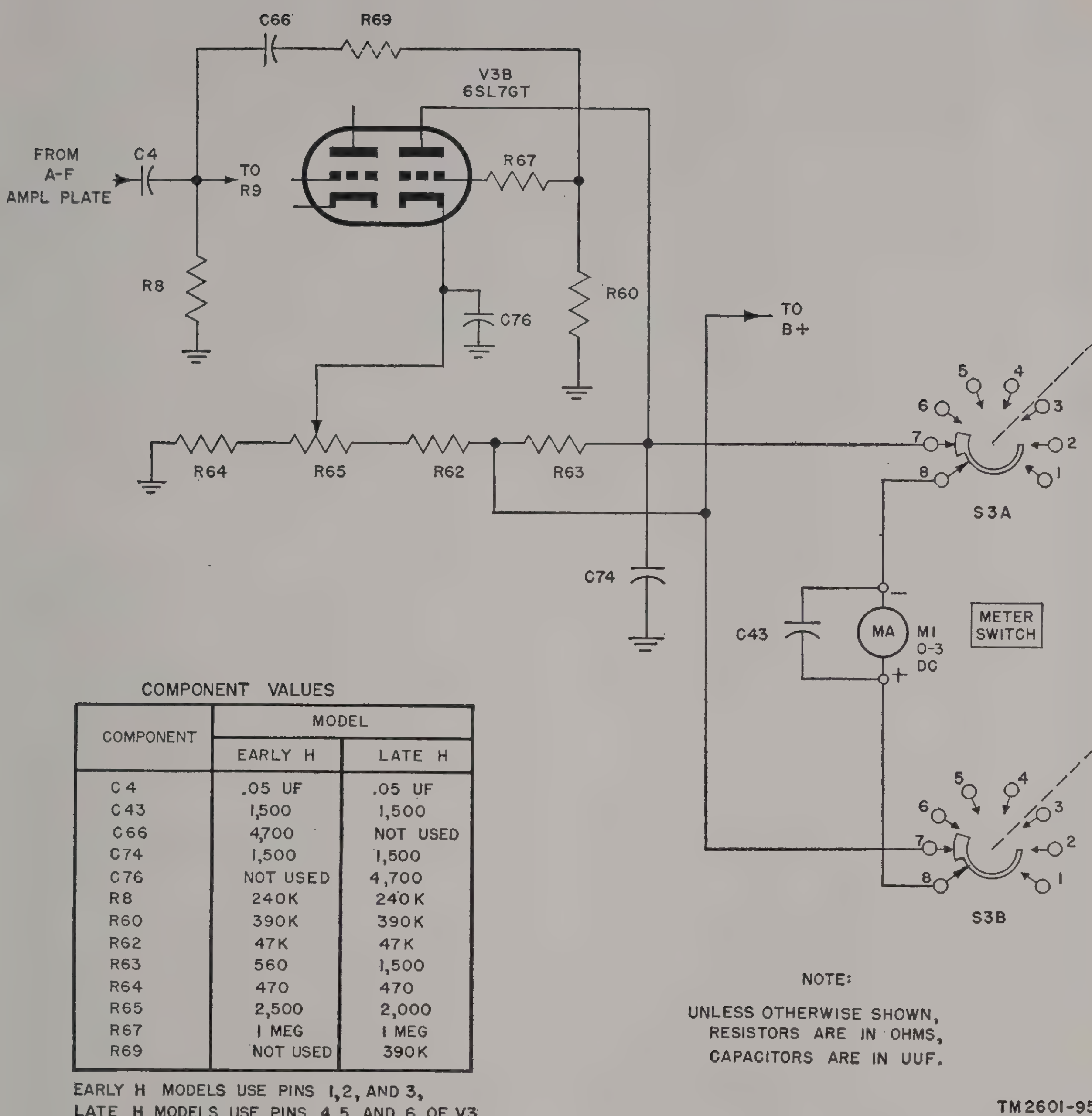
Figure 122. Audio input circuits.



COMPONENT	MODEL	
	EARLY H	LATE H
C4	.05 UF	.05 UF
C43	1,500	1,500
C66	4,700	NOT USED
C74	1,500	1,500
C76	NOT USED	4,700
R8	240K	240K
R60	390K	390K
R62	47K	47K
R63	560	1,500
R64	470	470
R65	2,500	2,000
R67	1 MEG	1 MEG
R69	NOT USED	390K

Figure 125. Vacuum-tube voltmeter circuit.

d. FREQUENCY-CORRECTING NETWORK. The frequency deviation produced by a phase modulator is proportional to the modulating frequency as well as the amplitude of the a-f signal. In order to produce frequency deviation that is independent of audio frequency and proportional only to the modulating signal, a frequency-correcting network with an output that is inversely proportional to frequency, must be inserted between the audio amplifier and the phase modulator. This is the function of resistor R9 and capacitor C6. Resistor R57 has been added in series with C6, in the H model, for further frequency correction. Resistor R11 isolates the rf on the phase-modulator grid from the audio circuits, and resistor R8 completes the d-c return for the grid of phase-modulator tube V3B.

e. SIMPLEXING CIRCUITS. In order to provide for telephone communication between Radio Terminal Set AN/TRC–3(*) and its as-

sociated Telephone Terminal CF–1–(*), simplexing circuits are provided in the A through H models of Radio Transmitter T–14(*)/TRC–1 and Radio Receiver R–19(*)/TRC–1 (fig. 124). The 500-ohm line line winding of high-fidelity audio input transformer T6 is center-tapped and brought out to one of a pair of terminals marked TELEPHONE EE–8, located on the panel of Radio Transmitter T–14(*)/TRC–1. A center tap on audio output transformer T112, located in Radio Receiver R–19(*)/TRC–1, is connected to the other telephone terminal through Cord CX–104/TRC–1 (between the receiver and transmitter). Telephone EE–8–(*), connected to these two terminals (P12 and P13), is thus provided with a simplexing circuit over the two pairs of spiral-four cable between Radio Terminal Set AN/TRC–3(*) and its associated Telephone Terminal CF–1–(*). This circuit does not interfere with the normal use of the multichannel circuits. Channel 1 may be used for an additional teletypewriter channel by replacing Telephones EE–8–(*) with Telegraph Terminals TH–1/TCC–1 (par. 177). In the unlettered model, simplexing is accomplished as shown in B, figure 124.

192. Vacuum-Tube Voltmeter

a. In the H model, the second triode section of tube V3 is used in a vacuum-tube voltmeter circuit, together with resistors R60, R62 through R65, R67, R69 (this replaces capacitor C66 which was used in early H models), and capacitor C74 (fig. 125). The VTVM is used to indicate the audio level at the output of V1B. This is accomplished by biasing the control grid circuit of the VTVM to cut-off or slightly beyond cut-off; positive peaks of the applied audio signal voltage will cause current to flow through the second section of V3; the magnitude of the current flow is a function of the amplitude of the applied audio signal. The unidirectional current pulses flow through plate load resistor R63, which shunts meter M1 in position 7 (MODULATION LEVEL). Since the meter cannot follow the envelope of the plate current pulses, the reading obtained is proportional to the average value of the plate current flow. At a reading of 1 ma, the audio input to the transmitter is 0 dbm. The relative meter indications are not linear at other input levels.

b. Resistors R62 and R64 and potentiometer R65 form a voltage divider to derive the bias voltage applied to the cathode of V3B. Thus resistor R65 adjusts the bias, providing a calibration adjustment for the VTVM. Resistor R60 completes the d-c return for the control grid, and R63 serves as a plate load which is shunted by meter M1 when the METER SWITCH is operated to position 7 (MODULATION LEVEL). Resistors R67 and R69 (or capacitor C66) reduce the loading effect of the VTVM grid-cathode circuit on the audio signal circuit, and therefore prevent any flattening of the positive audio peaks at the plate of the audio section of tube V1. Capacitor C74 is a plate r-f bypass. Capacitor C76 is an r-f bypass in the cathode circuit of the VTVM.

193. Metering Circuits

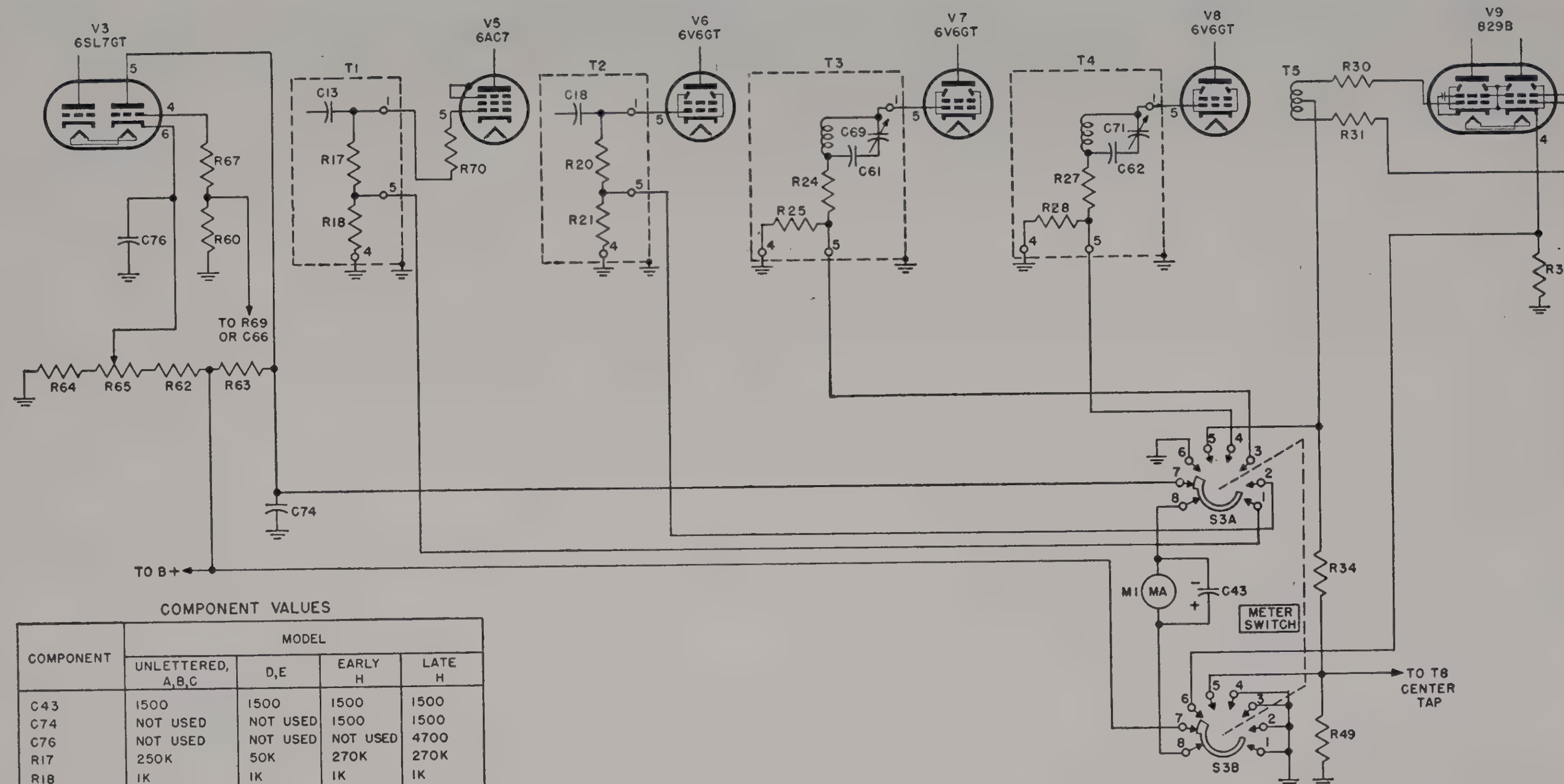
a. The six-position (seven-position in the H model) METER SWITCH, S3, connects the 0- to 3-ma meter, M1 to the necessary grid and plate circuits, to facilitate tuning and operation of the transmitter (fig. 126). Positions 1 to 5 connect the meter to the grid circuits of tubes V5 to V9, respectively. In position 6 of the METER SWITCH, the meter reads p-a (power-amplifier) cathode current.

b. In the D and E models, where the second section of the phase modulator tube is used as the first frequency doubler, tuning of transformer T11 is accomplished with the METER SWITCH at position 1, and the meter indicating grid current of tube V5 rather than the grid current of V3B.

c. In the H models, METER SWITCH, S3, has a seventh position (MODULATION LEVEL). The audio level at the output of V3B is indicated by the plate current flow in tube V3B (par. 192). Meter M1 is connected across resistor R63, part of the plate load for the VTVM tube V3B, when S3 is in position 7.

194. Power Supply

A functional diagram of the power circuits is given in figure 127. The self-contained power pack for Radio Transmitter T–14(*)/TRC–1 is designed to operate from a 115-volt (nominal), 50 to 60 cycles, a-c source, and supplies filament, plate, and relay power to the transmitter circuits.

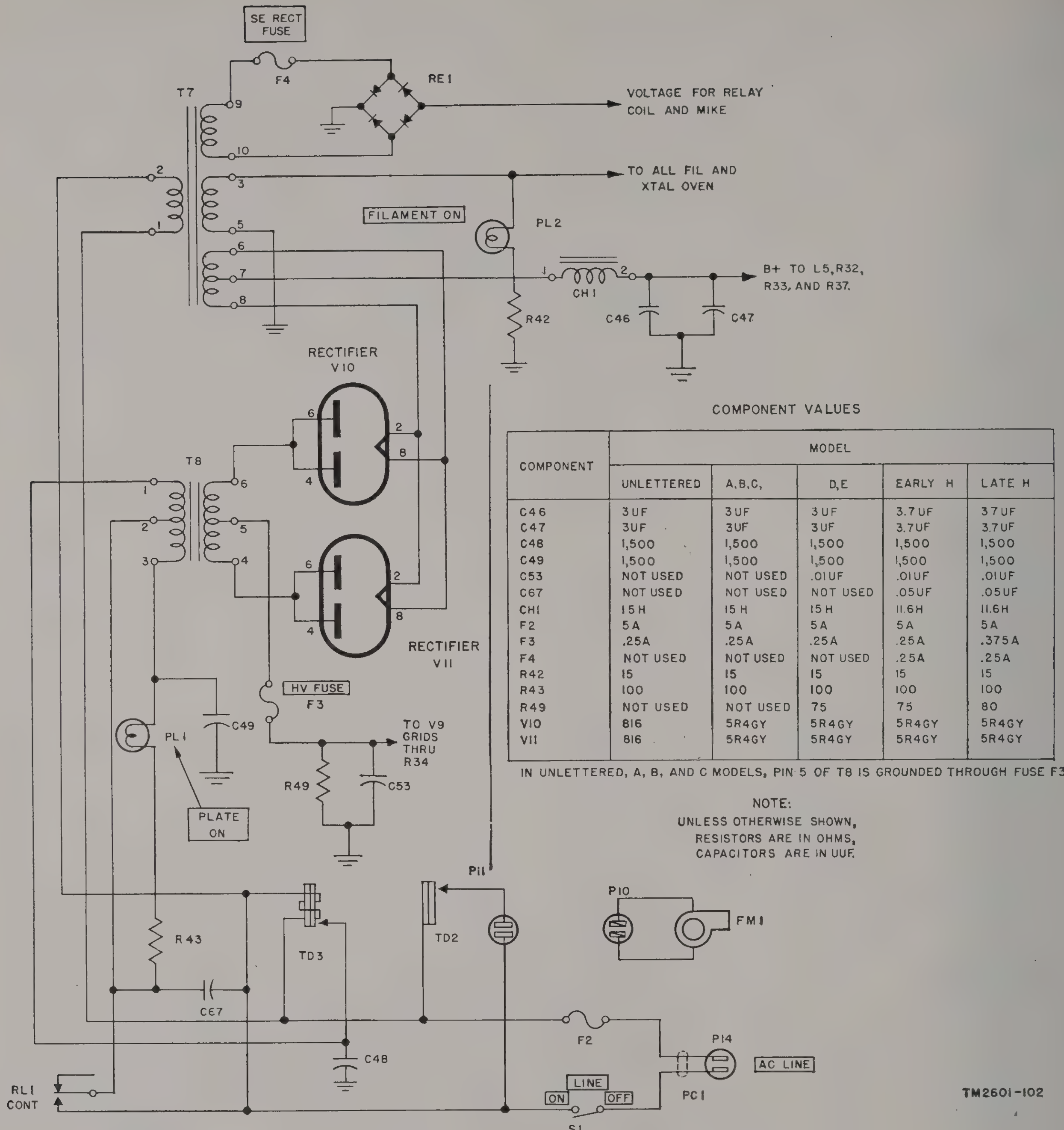


COMPONENT VALUES

COMPONENT	MODEL: UNLETTERED, A,B,C	MODEL: D,E	MODEL: EARLY H	MODEL: LATE H
C43	1500	1500	1500	1500
C74	NOT USED	NOT USED	1500	1500
C76	NOT USED	NOT USED	NOT USED	4700
R17	250K	50K	270K	270K
R18	1K	1K	1K	1K
R20	250K	250K	270K	270K
R21	1K	1K	1K	1K
R24	150K	150K	47K	47K
R25	1K	1K	1K	1K
R27	50K	50K	47K	47K
R28	1K	1K	1K	1K
R30	10K	5K	5100	5100
R31	10K	5K	5100	5100
R34	12.5	8.333	12.5	12.5
R35	.5	.3366	.5	.5
R49	NOT USED	75	75	80
R60	NOT USED	NOT USED	390K	390K
R62	NOT USED	NOT USED	47K	47K
R63	NOT USED	NOT USED	1500	1500
R64	NOT USED	NOT USED	470	470
R65	NOT USED	NOT USED	2500	2K
R67	NOT USED	NOT USED	1MEG	1MEG
R70	NOT USED	NOT USED	NOT USED	15

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF

Figure 126. Metering circuits.



COMPONENT VALUES

COMPONENT	MODEL				
	UNLETTERED	A,B,C,	D,E	EARLY H	LATE H
C46	3UF	3UF	3UF	3.7UF	37UF
C47	3UF	3UF	3UF	3.7UF	3.7UF
C48	1,500	1,500	1,500	1,500	1,500
C49	1,500	1,500	1,500	1,500	1,500
C53	NOT USED	NOT USED	.01UF	.01UF	.01UF
C67	NOT USED	NOT USED	NOT USED	.05UF	.05UF
CH1	15H	15H	15H	11.6H	11.6H
F2	5A	5A	5A	5A	5A
F3	.25A	.25A	.25A	.25A	.375A
F4	NOT USED	NOT USED	NOT USED	.25A	.25A
R42	15	15	15	15	15
R43	100	100	100	100	100
R49	NOT USED	NOT USED	75	75	80
V10	816	5R4GY	5R4GY	5R4GY	5R4GY
V11	816	5R4GY	5R4GY	5R4GY	5R4GY

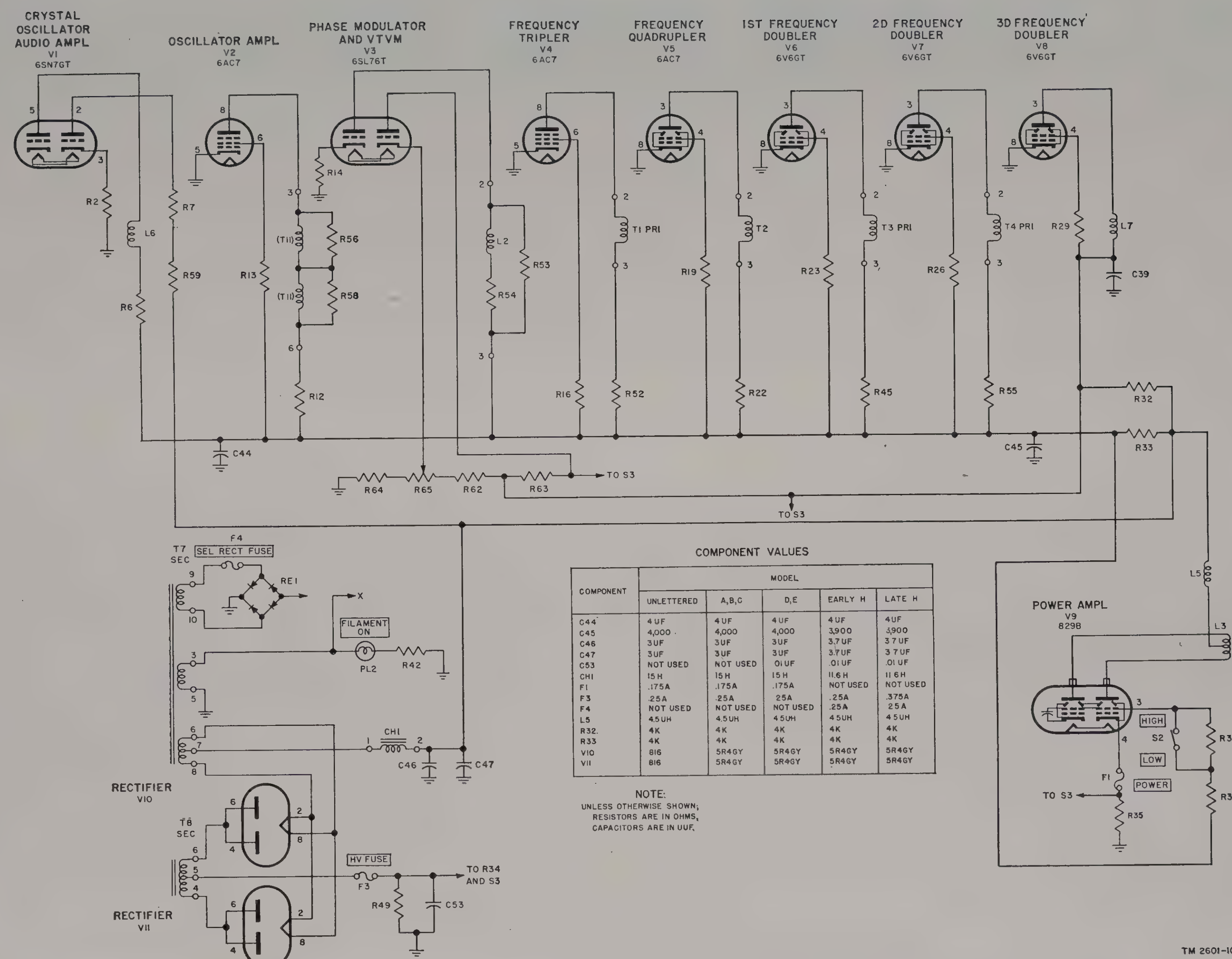
IN UNLETTERED, A, B, AND C MODELS, PIN 5 OF T8 IS GROUNDED THROUGH FUSE F3.

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

Figure 127. Power supply circuit.

a. Primary power is brought into Radio Transmitter T–14(*)/TRC–1 by means of power cord PC1 located at the bottom left of the transmitter panel. The input is fused by means of 5-ampere fuse F2 and is connected to the primary of filament transformer T7 through LINE ON-OFF switch S1. FILAMENT ON pilot light PL2 is energized from the 6.3-volt filament bus whenever the LINE ON-OFF switch is ON and power is applied to transmitter power input plug P14.

b. Transformer T7 has three secondary windings. The first winding supplies filament power at 6.3 volts to the transmitter tube heaters and heating power to the crystal oven. The second winding supplies current to heat the fila-



COMPONENT VALUES

COMPONENT	MODEL				
	UNLETTERED	A,B,C	D,E	EARLY H	LATE H
C44	4 UF	4 UF	4 UF	4 UF	4UF
C45	4,000	4,000	4,000	3,900	3,900
C46	3UF	3UF	3UF	3.7UF	3.7UF
C47	3UF	3UF	3UF	3.7UF	3.7UF
C53	NOT USED	NOT USED	.01 UF	.01 UF	.01 UF
CH1	15 H	15 H	15 H	11.6 H	11.6 H
F1	.175A	.175A	.175A	NOT USED	NOT USED
F3	.25A	.25A	.25A	.25A	.375A
F4	NOT USED	NOT USED	NOT USED	.25A	.25 A
L5	4.5UH	4.5UH	4.5UH	4.5UH	4.5UH
R32	4K	4K	4K	4K	4K
R33	4K	4K	4K	4K	4K
V10	816	5R4GY	5R4GY	5R4GY	5R4GY
V11	816	5R4GY	5R4GY	5R4GY	5R4GY

NOTE:
UNLESS OTHERWISE SHOWN;
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

Figure 128. B+ Distribution.

ments of power rectifier tubes V10 and V11. The third winding supplies voltage to selenium rectifier RE1, which produces approximately 25 volts dc to operate antenna and power control relay RL1, and to provide a source of local microphone current.

c. Plate power transformer T8 supplies approximately 700 volts ac to the plate of each of the 5R4GY (816 in the unlettered model) rectifier tubes. These act as a full-wave rectifier. The h-v rectifier output is fed through a choke input filter system consisting of choke CH1 and filter capacitor C46 and C47. The result is a substantially pure d-c output. H.V. FUSE F3 in the center-tap return of h-v transformer T8 protects the power supply in case of overloads or short circuit in the B+ circuits. Resistor R49 bypassed by capacitor C53 is a fixed biasing arrangement for the power amplifier tube (V9). In unlettered, A, B, and C models this arrangement and these two components do not appear. PLATE ON pilot lamp PL1, in series with R43, is connected between terminals 2 and 3 of T8. Capacitors C48 and C49, from primary leads 1 and 3 of T8 to ground, keep line r-f noise from entering the transmitter through the supply circuits.

195. B+ Distribution

a. Figure 128 shows B+ distribution in Radio Transmitter T–14(*)/TRC–1. Capacitor C44 provides additional filtering of the B+ lead for the h-v circuits of tubes V1 through V7. C45 is an r-f decoupling capacitor for this lead. Resistor R33 is a decoupling and voltage-dropping resistor for V1 through V7 (and the screen of V9); R32 is the decoupling and voltage-dropping resistor for V8. R37 is the screen voltage-dropping resistor and L5 is the plate circuit decoupling choke for tube V9.

b. The POWER HIGH LOW switch serves a dual purpose (fig. 128). In the LOW position, this switch places resistor R36 in series with the normal screen voltage-dropping resistor, R37, and lowers the screen voltage on p-a tube V9. This condition limits the plate current that can be drawn by that tube to a value that will not harm the tube under conditions of detuning or maladjustment. It is useful, therefore, as a tuning switch to reduce the plate current of the p-a tube to a safe value while making preliminary adjustments. It also serves to reduce the r-f power output of the transmitter from approximately 40 watts in the HIGH POWER position to less than 10 watts in the LOW POWER position. Low-power operation should be used whenever these equipments are close together or placed advantageously enough to give reliable communication with 10-watt output.

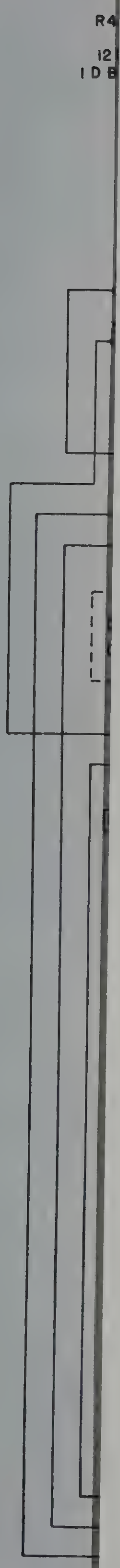
196. Control Circuits

a. With the LINE ON-OFF switch in the ON position, power is applied from A-C LINE plug P14 (P6 in the unlettered model) through LINE FUSE F2 to terminals 1 and 2 of transformer T7, time delay relay TD3, and thermostat TD2.

(1) Transformer T7 supplies voltage to the following components: selenium rectifier, filaments of V1 through V9, filaments of rectifier tubes V10 and V11, FILAMENT ON light PL2, PLATE ON light PL1, the heater of thermostatic time delay relay TD3, and relay TD1. Thermostatic relay TD1 is associated with the crystal oven in order to keep the oscillator crystal within a temperature range of approximately 55°C. and 60°C. (130°F. and 140°F.). This causes the oscillator frequency to remain relatively constant even though the surrounding temperature varies.

(2) Time delay relay TD3 delays the application of voltage to transformer T8 for a period of from 30 to 40 seconds from the time the LINE ON-OFF switch is placed ON, in order to allow the filaments of power rectifiers V10 and V11 to preheat. This prevents damage to the filaments upon application of high voltage.

(3) A third bimetallic thermostat, TD2, controls the 115-volt a-c input to exhaust fan motor FM1. This thermostat is located under the chassis and is in direct contact with it. When the chassis temperature rises higher than approximately 85°F., the thermostat closes its contacts and energizes the fan motor. When the chassis temperature drops below approximately 75°F., the


R4
12
IDB

ments of power rectifier tubes V10 and V11. The third winding supplies voltage to selenium rectifier RE1, which produces approximately 25 volts dc to operate antenna and power control relay RL1, and to provide a source of local microphone current.

c. Plate power transformer T8 supplies approximately 700 volts ac to the plate of each of the 5R4GY (816 in the unlettered model) rectifier tubes. These act as a full-wave rectifier. The h-v rectifier output is fed through a choke input filter system consisting of choke CH1 and filter capacitor C46 and C47. The result is a substantially pure d-c output. H.V. FUSE F3 in the center-tap return of h-v transformer T8 protects the power supply in case of overloads or short circuit in the B+ circuits. Resistor R49 bypassed by capacitor C53 is a fixed biasing arrangement for the power amplifier tube (V9). In unlettered, A, B, and C models this arrangement and these two components do not appear. PLATE ON pilot lamp PL1, in series with R43, is connected between terminals 2 and 3 of T8. Capacitors C48 and C49, from primary leads 1 and 3 of T8 to ground, keep line r-f noise from entering the transmitter through the supply circuits.

195. B+ Distribution

a. Figure 128 shows B+ distribution in Radio Transmitter T–14(*)/TRC–1. Capacitor C44 provides additional filtering of the B+ lead for the h-v circuits of tubes V1 through V7. C45 is an r-f decoupling capacitor for this lead. Resistor R33 is a decoupling and voltage-dropping resistor for V1 through V7 (and the screen of V9); R32 is the decoupling and voltage-dropping resistor for V8. R37 is the screen voltage-dropping resistor and L5 is the plate circuit decoupling choke for tube V9.

b. The POWER HIGH LOW switch serves a dual purpose (fig. 128). In the LOW position, this switch places resistor R36 in series with the normal screen voltage-dropping resistor, R37, and lowers the screen voltage on p-a tube V9. This condition limits the plate current that can be drawn by that tube to a value that will not harm the tube under conditions of detuning or maladjustment. It is useful, therefore, as a tuning switch to reduce the plate current of the p-a tube to a safe value while making preliminary adjustments. It also serves to reduce the r-f power output of the transmitter from approximately 40 watts in the HIGH POWER position to less than 10 watts in the LOW POWER position. Low-power operation should be used whenever these equipments are close together or placed advantageously enough to give reliable communication with 10-watt output.

196. Control Circuits

a. With the LINE ON-OFF switch in the ON position, power is applied from A-C LINE plug P14 (P6 in the unlettered model) through LINE FUSE F2 to terminals 1 and 2 of transformer T7, time delay relay TD3, and thermostat TD2.

(1) Transformer T7 supplies voltage to the following components: selenium rectifier, filaments of V1 through V9, filaments of rectifier tubes V10 and V11, FILAMENT ON light PL2, PLATE ON light PL1, the heater of thermostatic time delay relay TD3, and relay TD1. Thermostatic relay TD1 is associated with the crystal oven in order to keep the oscillator crystal within a temperature range of approximately 55°C. and 60°C. (130°F. and 140°F.). This causes the oscillator frequency to remain relatively constant even though the surrounding temperature varies.

(2) Time delay relay TD3 delays the application of voltage to transformer T8 for a period of from 30 to 40 seconds from the time the LINE ON-OFF switch is placed ON, in order to allow the filaments of power rectifiers V10 and V11 to preheat. This prevents damage to the filaments upon application of high voltage.

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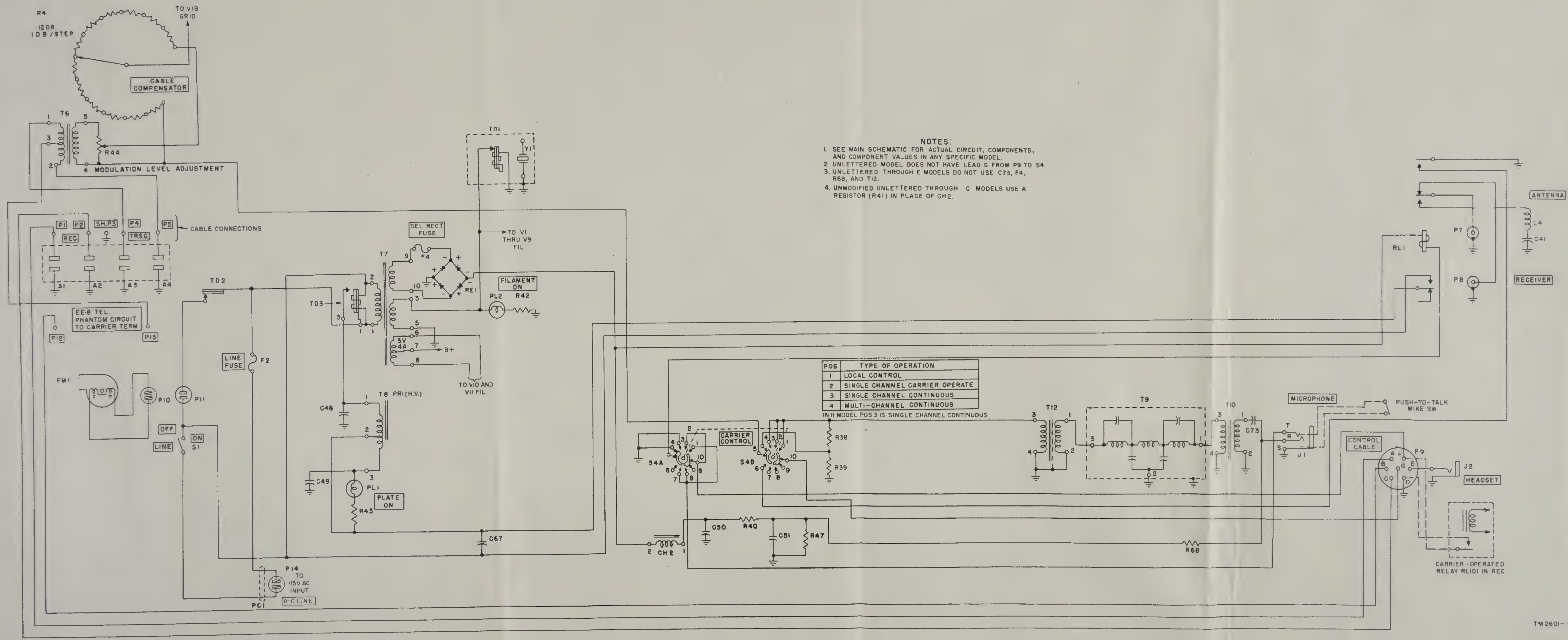


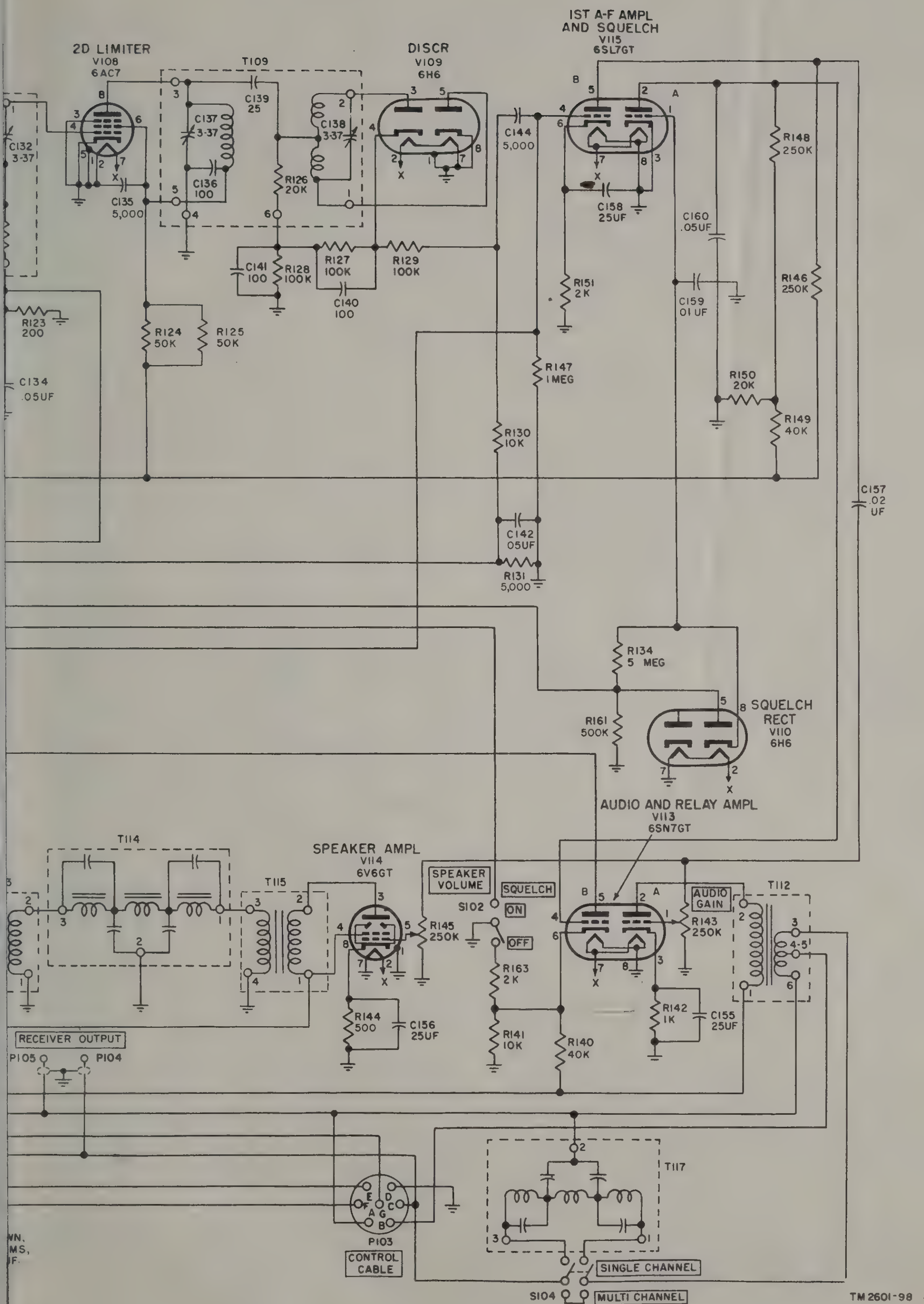
NOTES:
1. SEE MAIN SCHEMATIC FOR ACTUAL CIRCUIT, COMPONENTS, AND COMPONENT VALUES IN ANY SPECIFIC MODEL.
2. UNLETTERED MODEL DOES NOT HAVE LEAD G FROM P9 TO S4.
3. UNLETTERED THROUGH E MODELS DO NOT USE C73, F4, R68, AND T12.
4. UNMODIFIED UNLETTERED THROUGH C MODELS USE A RESISTOR (R41) IN PLACE OF CH2.

POS	TYPE OF OPERATION
1	LOCAL CONTROL
2	SINGLE CHANNEL CARRIER OPERATE
3	SINGLE CHANNEL CONTINUOUS
4	MULTI-CHANNEL CONTINUOUS

IN H MODEL POS 3 IS SINGLE CHANNEL CONTINUOUS

TM 2601-104

Figure 129. Control circuits and corrections.


2D LIMITER
V108
6AC7
T109
DISCR
V109
6H6
IST A-F AMPL
AND SQUELCH
V115
6SL7GT
C132
3-37
C139
25
C137
3-37
C136
100
C135
5,000
C138
3-37
R126
20K
C144
5,000
C158
25UF
C160
.05UF
R148
250K
R146
250K
C141
100
R128
100K
R127
100K
R129
100K
C140
100
R151
2K
C159
.01 UF
R123
200
R124
50K
R125
50K
R147
1 MEG
R150
20K
R149
40K
C134
.05UF
R130
10K
C142
.05UF
C157
.02
UF
R131
5,000
R134
5 MEG
R161
500K
SQUELCH
RECT
V110
6H6
AUDIO AND RELAY AMPL
V113
6SN7GT
T114
SPEAKER AMPL
V114
6V6GT
T115
SPEAKER
VOLUME
SQUELCH
S102
ON
OFF
R145
250K
AUDIO
GAIN
R143
250K
T112
R163
2K
R144
500
C156
25UF
R141
10K
R140
40K
R142
1K
C155
25UF
RECEIVER OUTPUT
P105
P104
T117
P103
CONTROL
CABLE
SINGLE CHANNEL
S104
MULTI CHANNEL
TM 2601-98

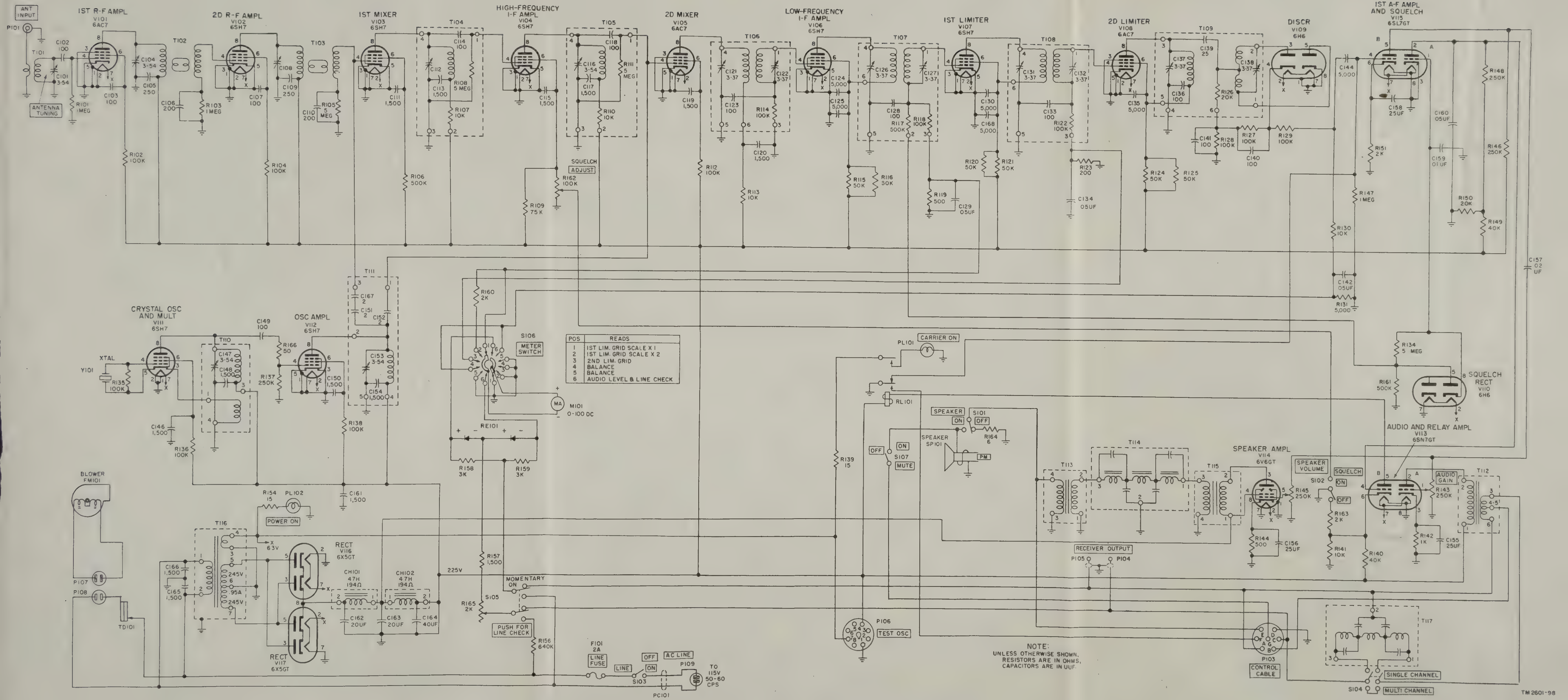
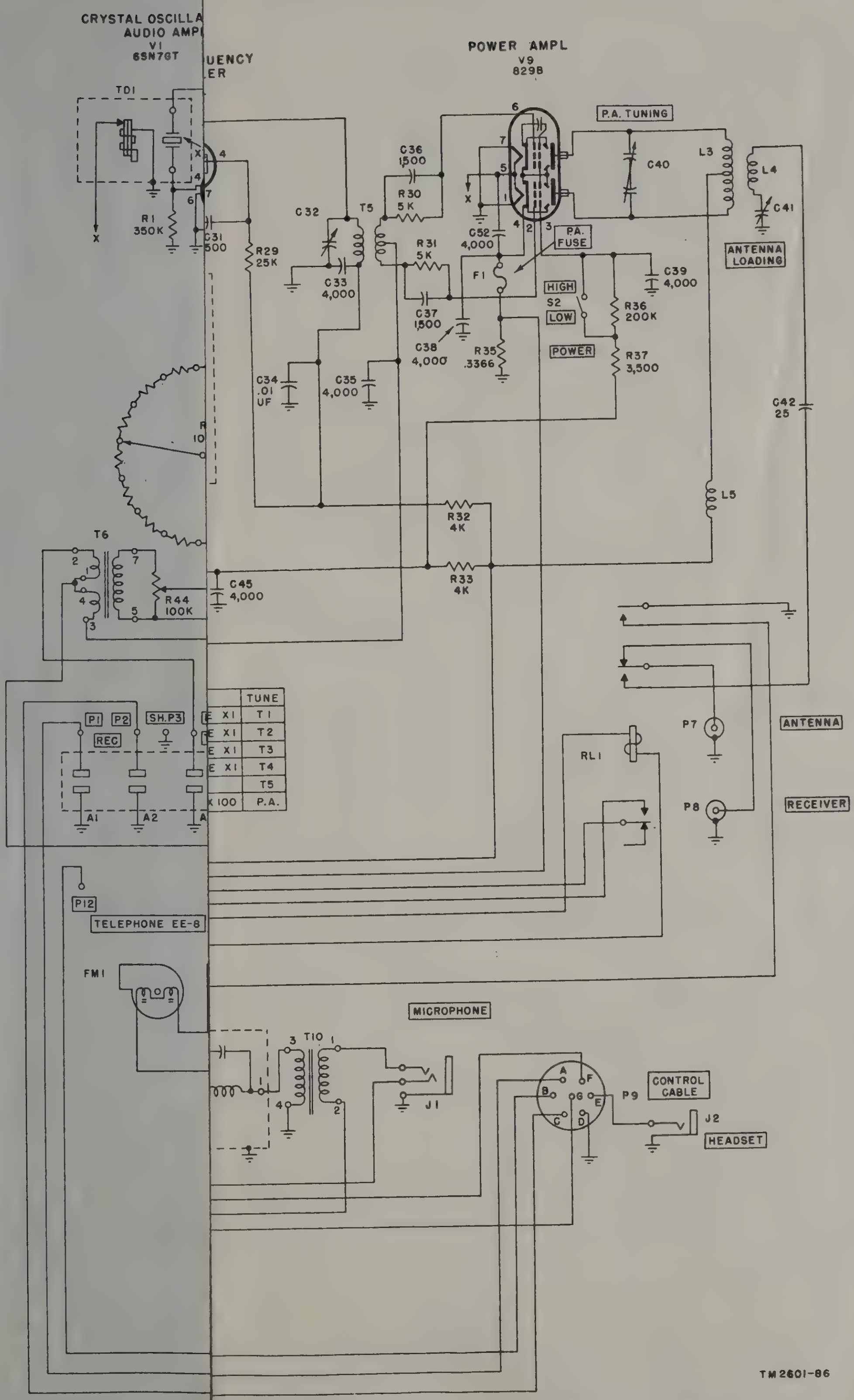
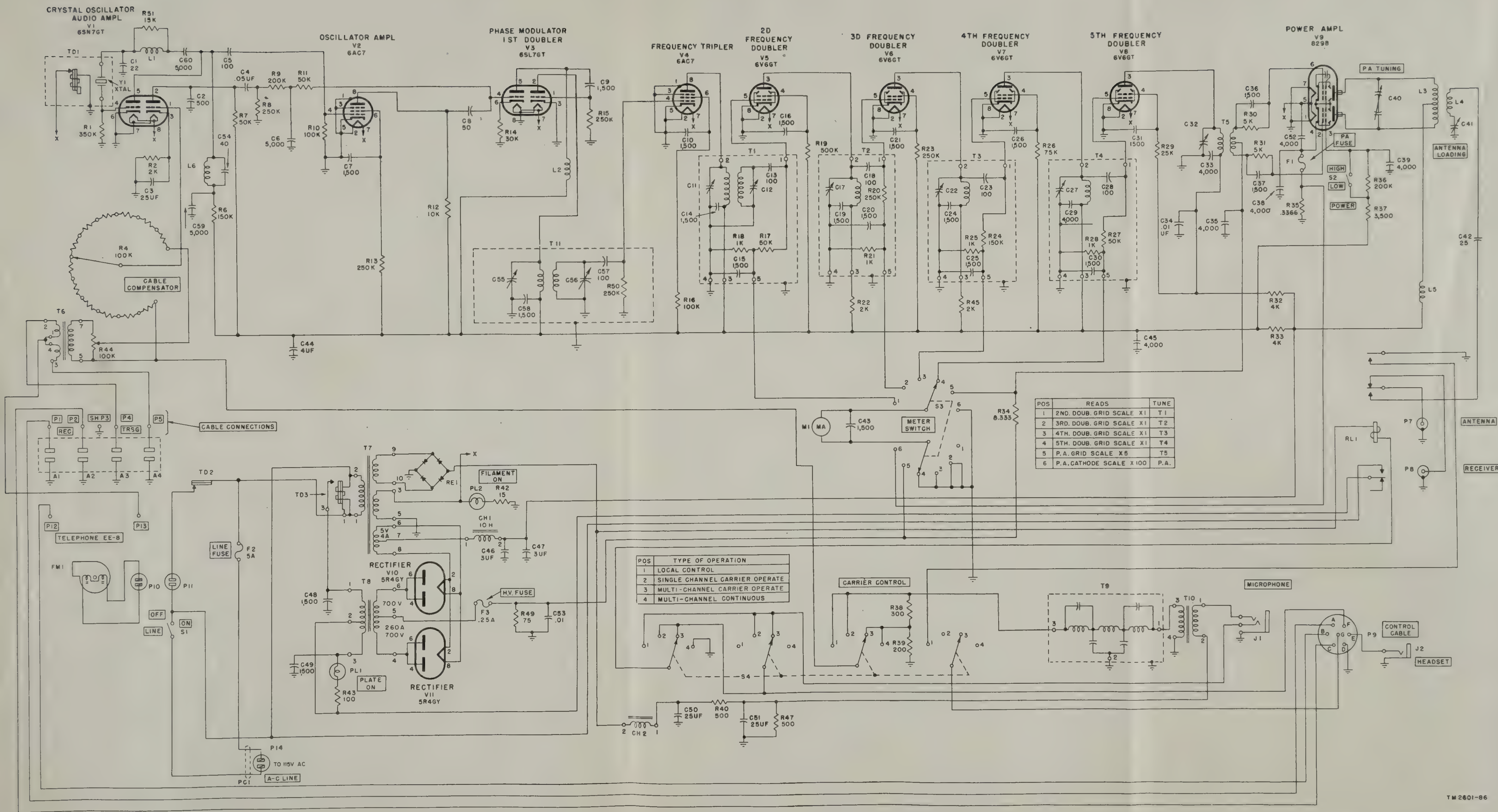


Figure 182. Radio Receivers R–19D/TRC–1 and R–19E/TRC–1, schematic diagram.



CRYSTAL OSCILLA
AUDIO AMPL
V1
6SN7GT
UENCY
ER
TO1
R1
350K
C31
500
R29
25K
C32
T5
C33
4,000
C34
.01
UF
C35
4,000
POWER AMPL
V9
829B
P.A. TUNING
C36
1,500
R30
5K
R31
5K
C52
4,000
C37
1,500
C38
4,000
F1
PA.
FUSE
R35
.3366
C40
L3
L4
C41
ANTENNA
LOADING
HIGH
S2
LOW
POWER
C39
4,000
R36
200K
R37
3,500
C42
25
L5
R32
4K
R33
4K
T6
C45
4,000
R44
100K
TUNE
T1
T2
T3
T4
T5
P.A.
P1
P2
SH.P3
REC
A1
A2
RL1
P7
ANTENNA
P8
RECEIVER
P12
TELEPHONE EE-8
FM1
MICROPHONE
T10
J1
P9
CONTROL
CABLE
J2
HEADSET

TM 2601-86



POS	READS	TUNE
1	2ND. DOUB. GRID SCALE X1	T1
2	3RD. DOUB. GRID SCALE X1	T2
3	4TH. DOUB. GRID SCALE X1	T3
4	5TH. DOUB. GRID SCALE X1	T4
5	P.A. GRID SCALE X5	T5
6	P.A. CATHODE SCALE X100	P.A.

POS	TYPE OF OPERATION
1	LOCAL CONTROL
2	SINGLE CHANNEL CARRIER OPERATE
3	MULTI-CHANNEL CARRIER OPERATE
4	MULTI-CHANNEL CONTINUOUS

Figure 186. Radio Transmitters T-14D/TRC-1 and T-14E/TRC-1, schematic diagram.

thermostat opens its contacts and turns off the fan.

b. CARRIER CONTROL switch S4 is used in conjunction with relay RL1 to determine the type of operation used. When relay RL1 is in an energized position it supplies ac to h-v rectifier tubes V10 and V11, which in turn develop plate and screen supply voltages for all of the tubes in the transmitter. Relay RL1, when it is energized, also switches the antenna from RECEIVER receptacle P8 to the transmitter output. Operation on each position of the CARRIER CONTROL switch is as follows:

(1) *Position 1.* The LOCAL CONTROL position allows the transmitter to be placed into operation by pressing the push-to-talk switch on the handset. With the switch depressed, the coil of relay RL1 is grounded through contact 1 of CARRIER CONTROL switch S4 and the contacts of the push-to-talk microphone switch, thus energizing the relay. In the D, E, and H models the receiver speaker is grounded through another set of contacts on switch S4 and another set of contacts on relay RL1, providing that the MUTE ON-OFF switch is ON. Switch S4 also connects the handset microphone signal from terminal 3 of filter T9 (transformer T12 in the H model) through the contacts of switch S4 to the CABLE COMPENSATOR and thus to the grid of audio amplifier V1B.

(2) *Position 2.* The SINGLE CHANNEL CARRIER OPERATE position allows the transmitter to be placed into operation by either the carrier operated relay in the receiver or by pressing the push-to-talk switch on the handset. With the carrier operated relay closed, relay RL1 is energized through the contacts of switch S4 and the contacts of the carrier operated relay in the receiver. With the push-to-talk switch closed, relay RL1 is energized through the contacts of switch S4 and the contacts of the push-to-talk switch. Filter T9 and the CABLE COMPENSATOR are connected as in (1) above.

(3) *Position 3.* This position differs in the unlettered through E model transmitters from that of the H model.

(*a*) In the H model, the SINGLE CHANNEL CONTINUOUS position allows the transmitter to operate continuously for single channel use. Relay RL1 is continuously energized through contacts 5 and 3 of switch S4A. The microphone channel modulates the carrier 100 percent as the lead to the audio amplifier V1B grid is taken off from the high-output end of R38. Switch S4 is connected accordingly (fig. 187).

(*b*) In the unlettered through E models, position 3 is the MULTI-CHANNEL OPERATE position. This allows the transmitter to be placed into multi-channel operation by either the carrier operate relay in the receiver or by pressing the push-to-talk switch on the handset. The microphone channel modulates the carrier only 30 percent as the lead to the audio amplifier V1B grid is taken off from between R38 and R39. Switch S4 is connected accordingly (figs. 184 through 186).

(4) *Position 4.* The MULTI-CHANNEL CONTINUOUS position allows the transmitter to operate continuously on multi-channel operation. Relay RL1 is continuously energized through the contacts of switch S4. Only a portion of the microphone channel signal voltage is selected from the voltage divider consisting of resistors R38 and R39; this results in 30 percent modulation by the microphone channel.

Section II. THEORY OF RADIO RECEIVER R–19(*)/TRC–1

197. Simplified Block Diagram

a. General. Radio Receiver R–19(*)/TRC–1 operates on any single preset channel in the frequency range of 70 to 100 mc and is designed to receive f-m signals having a maximum deviation of ±30 kc. Its circuit design is similar to that of the conventional superheterodyne type receiver used in the reception of a-m signals but differs in the following respects:

(1) The first difference lies in the band-pass characteristics. Since the carrier frequency varies over a band of ± 30 kc about the mean carrier frequency, the receiver has to accept a band at least 60 kc wide. Therefore, the i-f transformers are designed to pass a wide band.

(2) The second difference is that, since only variations in frequency are to be converted into intelligence, amplitude variations in the signal due to noise, fading, and other atmospheric disturbances must be removed. This function is accomplished by the limiter stages. These stages operate as saturated amplifiers; that is, an increase in the input to the amplifiers above a certain level will cause no increase in their output. Thus, they limit the magnitude of the signal applied to the detecting device to a constant level. The excellent signal-to-noise ratio obtained in Radio Receiver R–19(*)/TRC–1 is largely due to the use of two limiter stages in cascade. Signals too weak to saturate the first limiter effectively, saturate the second limiter, which removes whatever amplitude variations the first limiter has permitted to pass.

(3) The third difference is in the method of detection, that is, the conversion of frequency variations (instead of changes in amplitude of the r-f wave) into a-f voltage variations. This function is performed by the discriminator circuit, composed of transformer T109 and tube V109, together with other associated equipment.

b. Block Diagram.

(1) The relationship between the stages of the receiver and the various frequencies in it is shown in the block diagram (fig. 130). The receiver uses a double-conversion superheterodyne circuit. Two stages of tuned r-f amplification, tubes V101 and V102, precede the first mixer stage, tube V103, which converts the incoming signal frequency to the high i.f. One stage of h-f i-f amplification, tube V104, follows the first mixer and feeds second mixer tube V105. Second mixer V105 converts the h-f i-f signal to a low i.f. of 5 mc. Crystal oscillator-multiplier tube VIII, followed by the oscillator-amplifier tube V112, provides the local heterodyning frequency for both conversions. Second mixer tube V105 is followed by one stage of i-f amplification at 5 mc, using l-f i-f amplifier tube V106. The output of tube V106 is fed into the two limiter stages, tubes V107 and V108. The limiters are followed by the discriminator stage, tube V109.

(2) After a single stage of audio amplification in tube V115B, the a-f circuit is split into two distinct outputs. One branch is fed to a high-fidelity audio amplifier, tube V113A, while the other is fed to the speaker amplifier, tube V114. The high-fidelity output may be passed through the 3,000-cycle low-pass filter during single-channel operation.

(3) Voltage from the grid circuit of first limiter tube V107 is fed through squelch rectifier tube V110 to squelch amplifier tube V115A and squelch relay amplifier tube V113B to complete the carrier-operated relay circuit.

(4) All r-f and i-f stages in the receiver operate with no fixed-bias or cathode-bias resistors. This method of operation is permissible and even desirable in f-m receivers since amplitude linearity is not required. By operating at zero grid bias, each stage works at maximum amplification and also contributes to the limiting action (par. 204).

198. R-F Amplifiers

a. First R-F Amplifier (fig. 131). The first r-f amplifier uses a type 6AC7 tube (V101). The primary winding of antenna input transformer T101 is designed for coupling to a 50-ohm coaxial cable. The secondary of transformer T101 is resonated to the signal frequency by ANTENNA TUNING capacitor C101 and the voltage developed across the secondary is coupled to the control grid of tube V101 by d-c blocking capacitor C102. R101 is the grid re-

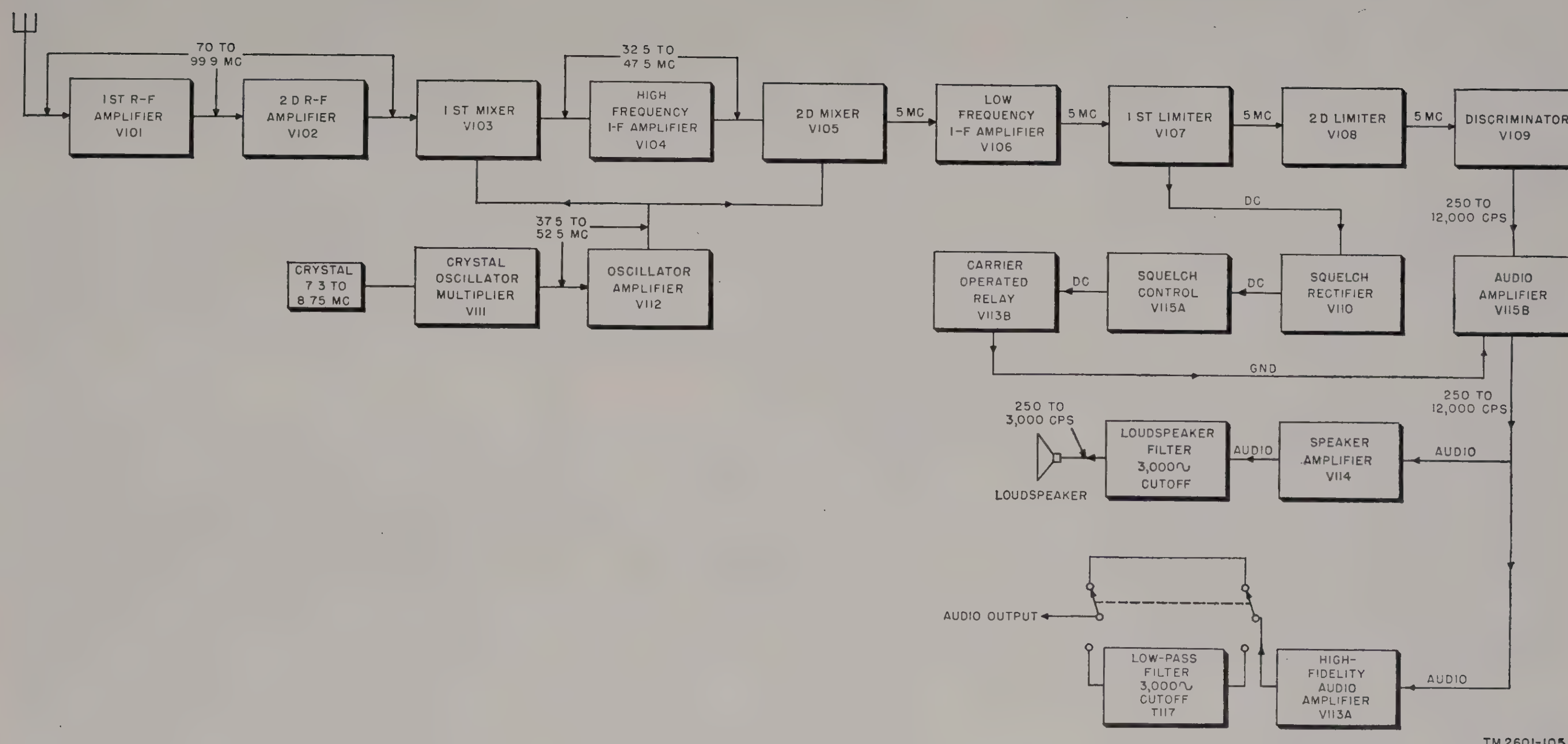


Figure 130. Receiver block diagram.

sistor. R102 is the screen-grid voltage-dropping resistor. Capacitor C103 keeps the screen grid at r-f ground potential. The plate of tube V101 is connected to the source of plate voltage through the primary inductor in r-f transformer T102. This inductor is tuned to resonance with the signal frequency by trimmer capacitor C104. Capacitor C105 bypasses the plate-voltage supply line to ground and completes the T102 primary r-f circuit. A one-turn link couples the primary inductor of r-f transformer T102 to the secondary inductor which, with the circuit and tube capacitance of V102 across it, is self-resonant near the h-f end of the tuning range of 70 to 100 mc to provide substantially uniform gain over the band.

couples the primary inductor of r-f transformer T103 to the secondary inductor which, with the circuit and tube capacitance (of V103) across it, is self-resonant near the high-frequency end of the tuning range of 70 to 100 mc in order to provide substantially uniform gain over the band.

199. Crystal Oscillator-Multiplier and Oscillator Amplifier

a. GENERAL. The circuit used in the receiver is a double-conversion superheterodyne type which uses one oscillator for both conversions. This system has the advantage of using the same number of tubes as a conventional superhetero-

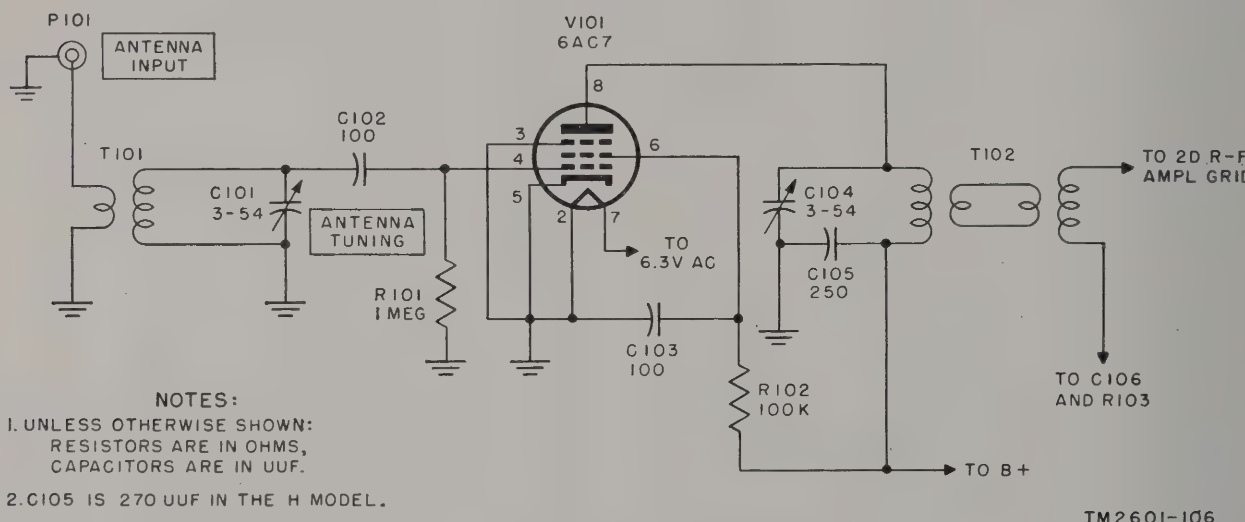


Figure 131. First r-f amplifier.

b. SECOND R-F AMPLIFIER (fig. 132). The second r-f amplifier circuit uses a type 6SH7 tube (V102). The r-f signal appearing across the secondary winding of r-f transformer T102 is coupled directly into the grid of V102. R103 is the grid resistor, and the r-f grid circuit is completed to ground by capacitor C106. R104 is the screen-grid voltage-dropping resistor, and capacitor C107 bypasses the screen grid to ground. The plate of tube V102 is connected to the source of plate voltage through the primary inductor in r-f transformer T103. This inductor is tuned to resonance with the signal frequency by trimmer capacitor C108. Capacitor C109 bypasses the plate voltage supply line and the T103 primary r-f circuit to ground. A one-turn link

dyne but with a much higher gain. It preserves a high signal-to-noise ratio and insures low response to spurious frequencies. The first or high i.f. used in this system is variable and is different for each carrier frequency. The theory of this system can be understood easily from the following explanation: If an oscillator frequency of one-half the carrier frequency were mixed with the carrier, an i.f. of one-half the carrier frequency would be produced.

Carrier frequency	100.0 mc
Oscillator frequency	50.0 mc
First i.f.	50.0 mc

Increasing the oscillator frequency a given amount above one-half the carrier frequency would produce an i.f. of the same frequency dif-

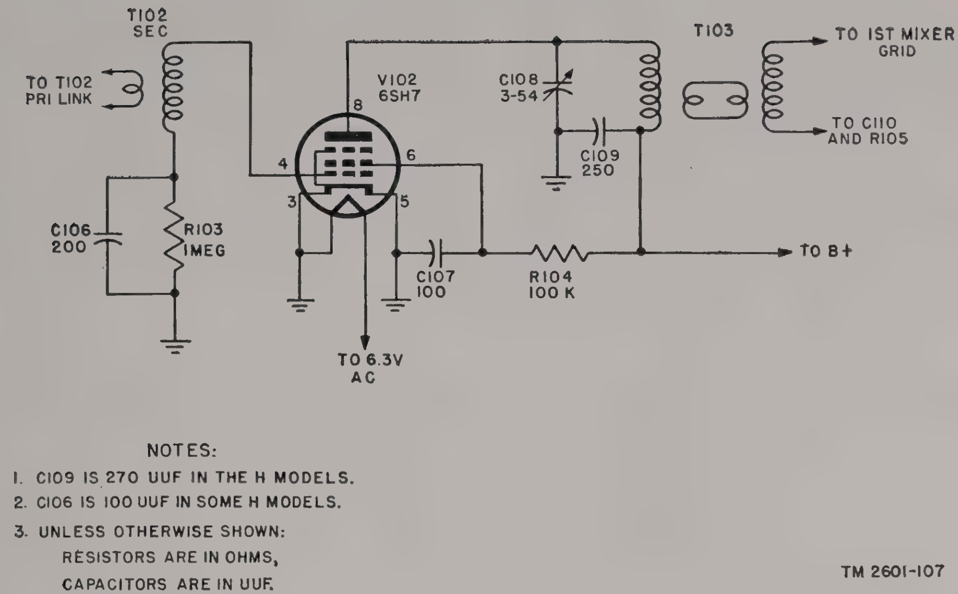


Figure 132. Second r-f amplifier.

ference below one-half the carrier frequency.

Carrier frequency	100.0 mc
Oscillator frequency	52.5 mc
First i.f.	47.5 mc

By beating the oscillator against the first i.f., a second or low i.f. would be produced which would be equal to the difference between the oscillator frequency and the first i.f.

Oscillator frequency	52.5 mc
First i.f.	47.5 mc
Second i.f.	5.0 mc

The receiver thus has a second intermediate frequency of 5 mc. Since the oscillator frequency is 2.5 mc greater than one-half the carrier frequency, the first i.f. is, therefore, 2.5 mc less than one-half the carrier frequency. Mixing the oscillator frequency and the first i.f. always produces a frequency of 5 mc, which is the fixed second i.f. The oscillator frequency, therefore, is determined by adding the second i.f. to the carrier frequency and dividing the sum by two.

Carrier frequency	100.0 mc
Second i.f.	5.0 mc
	105.0 mc

$$\text{Oscillator frequency} = \frac{105.0}{2} = 52.5 \text{ mc}$$

In this receiver the oscillator frequency (output of V111 and V112) varies over a range of 37.5 and 52.5 mc. Therefore, the oscillator converts the signal frequency (70 to 100 mc) to the first i.f. of 32.5 to 47.5 mc and then to the second i.f. of 5 mc.

b. Crystal Oscillator - Multiplier (fig. 133). The crystal-oscillator stage uses a type 6SH7 tube (V111) in a circuit capable of developing strong harmonics of the crystal frequency. The crystal frequency varies between 7.3 and 8.75 mc. The oscillator operates on the fifth or sixth harmonic of the crystal frequency depending on the frequency of the incoming signal. The crystal is connected between the grid and cathode of tube V111 and is shunted by grid-leak resistor R135. The cathode of tube V111 is connected to ground through one of the inductors of transformer T110 which, by means of the second inductor, couples it to the plate circuit of the tube. Thus the cathode currents, at harmonic frequencies of the crystal, develop voltages across the cathode coil which serve to increase the output of the oscillator at harmonic frequencies. R136 is the screen-grid voltage-dropping resistor, and C146 is the screen-grid bypass capacitor. The plate voltage of tube V111 is fed through the second inductor in the crystal-oscillator plate-tuning transformer, T110. This inductor is tuned to the fifth or sixth harmonic of the crystal frequency by trimmer capacitor C147. Capacitor C148 bypasses the plate circuit to ground.

c. OSCILLATOR AMPLIFIER (fig. 134). The oscillator-amplifier stage uses a type 6SH7 tube (V112). The amplifier serves not only to insure sufficient heterodyning frequency voltage but also to suppress unwanted harmonics of the crystal frequency that would result in the reception of spurious signal frequencies. The r-f voltage developed across the inductor in the crystal oscillator-multiplier plate-tuning transformer, T110, is coupled to the grid of tube plate tuning circuit. The heterodyning voltage appearing across the inductor is coupled to the grid of first mixer tube V103 by the small blocking capacitor, C151. C167 has been added (in the A through H models) in series with C151 to drop the heterodyning voltage applied to the V103 grid. A portion of the oscillator-amplifier output is coupled to the grid of second mixer tube V105 by small blocking capacitor C152.

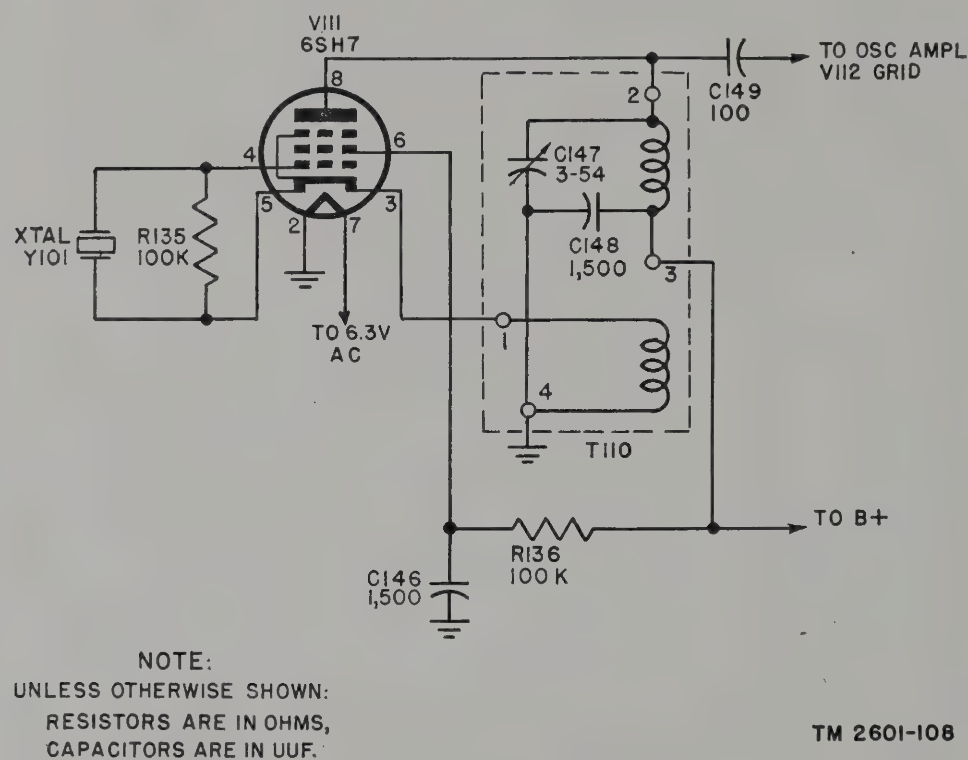


Figure 133. Crystal oscillator-multiplier stage.

V112 by d-c blocking capacitor C149. Resistor R166 (not used in the unlettered through C models) is connected in series with C149 to prevent the oscillator amplifier from breaking into oscillation. R137 is the grid-return resistor. R138 is the screen-grid voltage-dropping resistor and the screen-grid is bypassed to ground by capacitor C150. The plate of V112 receives its operating potential through the inductor in the oscillator-amplifier plate-tuning transformer, T111, which is tuned to resonance at 5 or 6 times (depending on the operating frequency of the receiver) the crystal frequency by trimmer capacitor C153*c* below. Capacitor C154 bypasses the plate circuit to ground and completes the r-f

d. RELATION OF CRYSTAL FREQUENCY TO OPERATING FREQUENCY. For operating frequencies from 70.0 mc to 82.5 mc, the crystal oscillator-multiplier and the oscillator-amplifier transformers, T110 and T111, tune to the fifth harmonic of the crystal frequency. The crystals for this operating band range from 7,500 kc to 8,750 kc. For operating frequencies from 82.6 mc to 99.9 mc, crystal oscillator-multiplier and oscillator-amplifier transformers T110 and T111 tune to the sixth harmonic of the crystal frequency. The crystals for this operating band range from 7,300 kc to 8,541.7 kc. The following formulas show the crystal frequency for any operating frequency:

(1) For the 70-mc to 82.5-mc band:

$$\text{Crystal frequency} = \frac{\text{operating frequency} + 5\text{ mc}}{10}$$

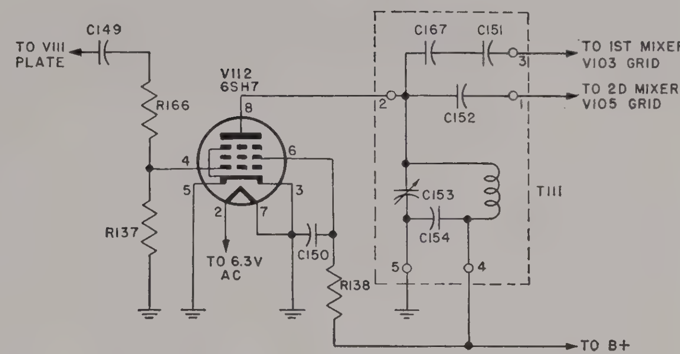
(2) For the 82.6-mc to 99.9-mc band:

$$\text{Crystal frequency} = \frac{\text{operating frequency} + 5\text{ mc}}{12}$$

COMPONENT VALUES

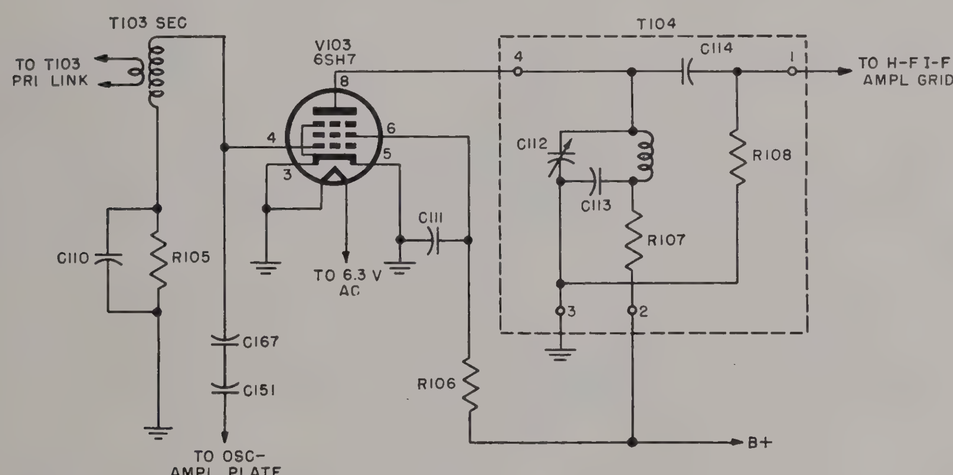
COMPONENT	MODEL			
	UNLETTERED	A,B,C	D,E	H
C149	100	100	100	100
C150	1,500	1,500	1,500	1,500
C151	2	2	2	2
C152	2	2	2	2
C153	3-54	3-54	3-54	3-54
C154	1,500	1,500	1,500	1,500
C167	NOT USED	2	2	2
R137	250 K	250 K	250 K	240
R138	100 K	100 K	100 K	100 K
R166	NOT USED	NOT USED	50	51

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.



TM 2601-109

Figure 134. Oscillator amplifier.



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED	A,B,C,D,E	H
C110	200	200	200
C111	1,500	1,500	1,500
C112	3-54	3-54	3-54
C113	1,500	1,500	1,500
C114	100	100	100
C151	2	2	2
C167	NOT USED	2	2
R105	5 MEG	5 MEG	5.1 MEG
R106	500K	500K	510K
R107	10K	10K	10K
R108	5 MEG	5 MEG	5.1 MEG

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

TM 2601-110

Figure 135. First mixer stage.

968874—52—16

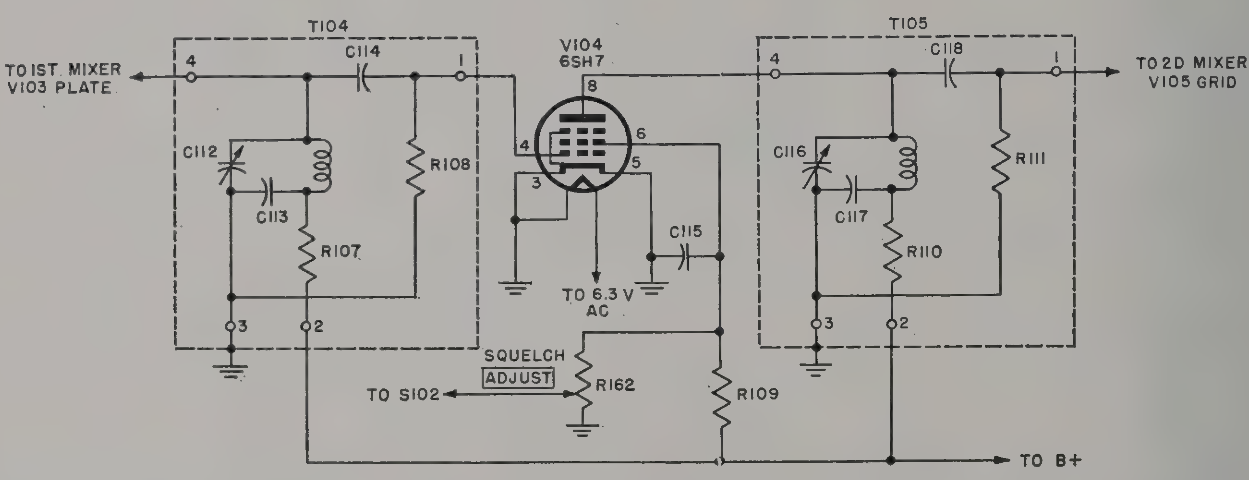
200. First Mixer

A functional diagram of the first mixer is shown in figure 135. The first mixer stage uses a type 6SH7 tube (V103). The amplified single voltage, developed across the secondary inductor in r-f transformer T103, is fed directly to the grid of V103. R105 is the grid resistor, and the grid circuit is bypassed to ground by capacitor C110. The signal frequency (70 to 100 mc) is converted to the high i.f. (32.5 to 47.5 mc) by combining it with the output of the oscillator-amplifier V112. The output of V112 is fed into the grid circuit of first mixer V103 through capacitors C151 and C167. (C167 is not used in the unlettered model.) R106 is the screen-grid voltage-dropping resistor, and the screen grid is bypassed to ground by capacitor C111. The plate of tube V103 receives its operating potential through the inductor in i-f transformer T104 and isolation resistor R107. Capacitor C113 bypasses the plate circuit to ground and completes the r-f plate tuning circuit. Trimmer capacitor C112 tunes the inductor to the high i.f. (32.5 to 47.5 mc).

201. High I-F Amplifier

a. A type 6SH7 tube (V104) is used in the high i-f stage (fig. 136). The output of mixer tube V103 is coupled to the grid of V104 by blocking capacitor C114. R108 is the grid-return resistor. R109 is the screen-grid voltage-dropping resistor; the screen grid is bypassed to ground by capacitor C115. The plate of tube V104 receives its operating potential through the inductor in i-f transformer T105. T105 is tuned to resonance at the high intermediate frequency by trimmer capacitor C116. R110 is an r-f isolation resistor and capacitor C117 bypasses the plate circuit to ground and completes the r-f plate tuning circuit.

b. In the A through H models, squelch ADJUST control R162 is connected from the screen



NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED	A,B,C,D,E	H
C112	3-54	3-54	3-54
C113	1,500	1,500	1,500
C114	100	100	100
C115	1,500	1,500	1,500
C116	3-54	3-54	3-54
C117	1,500	1,500	1,500
C118	100	100	100
R107	10K	10K	10K
R108	5 MEG	5 MEG	5.1 MEG
R109	100K	75K	75K
R110	10K	10K	10K
R111	5 MEG	5 MEG	150K
R162	NOT USED	100K	100K
V104	6AC7	6SH7	6SH7

TM 2601-111

Figure 136. High i-f amplifier.

grid to ground. This control varies the screen-grid voltage, thereby changing the r-f gain of this stage and, therefore, that of the whole receiver. The position of the control determines the input signal strength needed to operate squelch relay RL101 (par. 210).

202. Second Mixer

A type 6AC7 tube (V105) is used in the second mixer (fig. 137). The amplified high i-f voltage appearing across the inductor in i-f transformer T105 is coupled to the grid of V105 by d-c blocking capacitor C118. R111 is the grid return resistor. The high i-f signal (32.5 to 47.5 mc) is converted to the second i.f. (5 mc) by combining it with the output of oscillator-amplifier tube V112 in the grid circuit of the second mixer tube V105. The oscillator-amplifier output is coupled to V105 through C152. R112 is the screen-grid voltage-dropping resistor and the screen grid is bypassed to ground by capacitor C119. The plate of tube V105 receives its operating potential through the primary winding of i-f transformer T106 and isolation resistor R113. The primary and secondary windings of i-f transformer T106 are tuned to the 5-mc i.f. by trimmer capacitors C121 and C122, respectively. Capacitor C120 bypasses the plate circuit to ground.

203. Low I-F Amplifier

A type 6SH7 tube (V106) is used in the low i-f amplifier stage (fig. 138). The i-f voltage developed across the secondary of i-f transformer T106 is coupled directly to the grid of V106. C122 resonates the secondary of T106 to 5 mc. R114 is the grid-return resistor and is bypassed by capacitor C123. Both the screen grid and the plate of tube V106 receive their operating voltages through decoupling and voltage-dropping

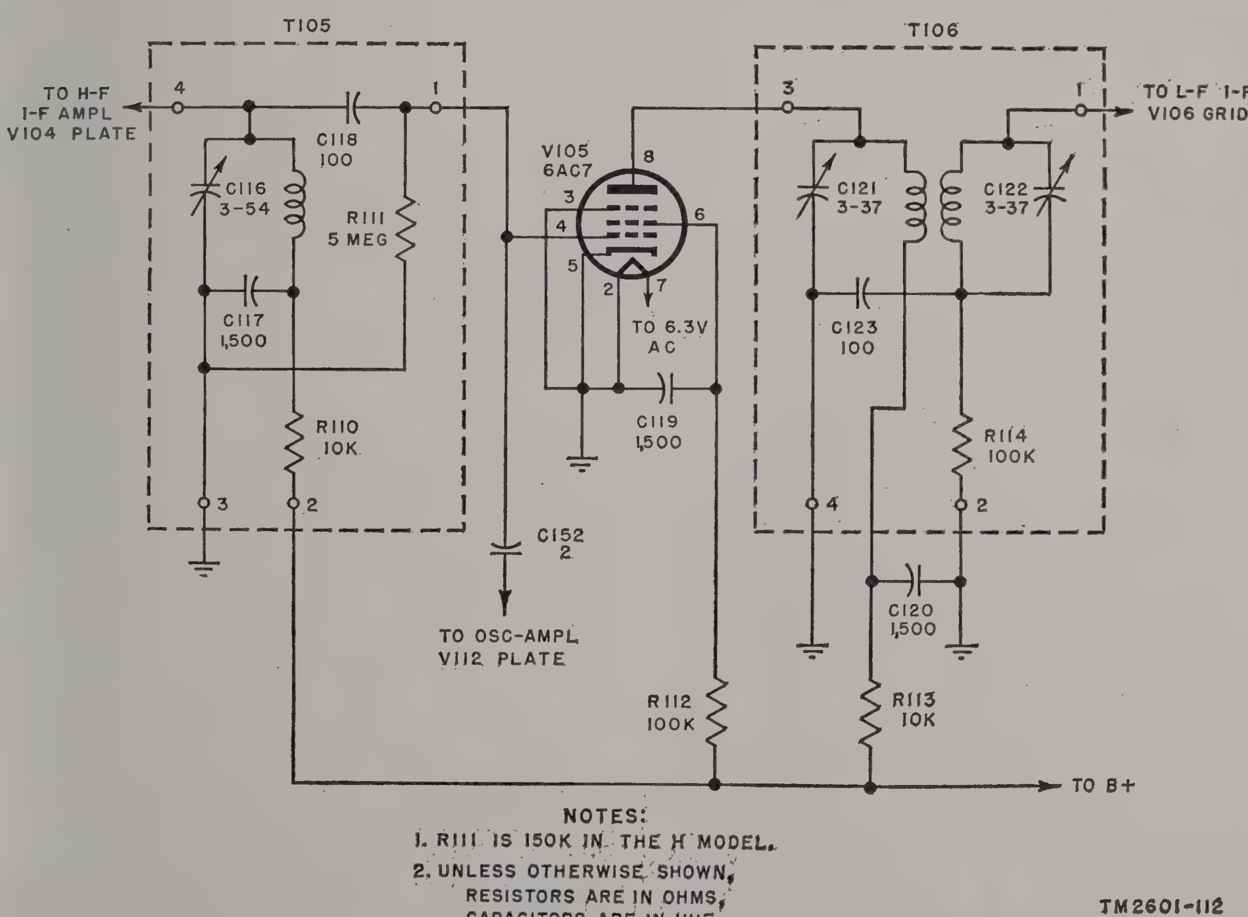


Figure 137. Second mixer.

resistors R115 and R116 in parallel (R115 only in the H model). Both circuits are bypassed to ground by capacitors C124 and C125. The plate current of V106 flows through the primary winding of i-f transformer T107; this is resonated to the 5-mc i.f. by trimmer capacitor C126.

plate current. Saturation occurs at a relatively low level of grid voltage because of the low plate and screen-grid voltages used. The sizes of the grid-biasing resistors, R118 and R122, and their associated bypass capacitors, C128 and C133, have been chosen so that the low i.f. (5 mc) will

COMPONENT VALUES

COMPONENT	MODEL: UNLETTERED, A, B, C, D, E	MODEL: H
C120	1,500	1,500
C121	3-37	3-37
C122	3-37	3-37
C123	100	100
C124	5,000	5,100
C125	5,000	5,100
C126	3-37	3-37
R113	10 K	10K
R114	100K	100K
R115	50K	24K
R116	50K	NOT USED

NOTES:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

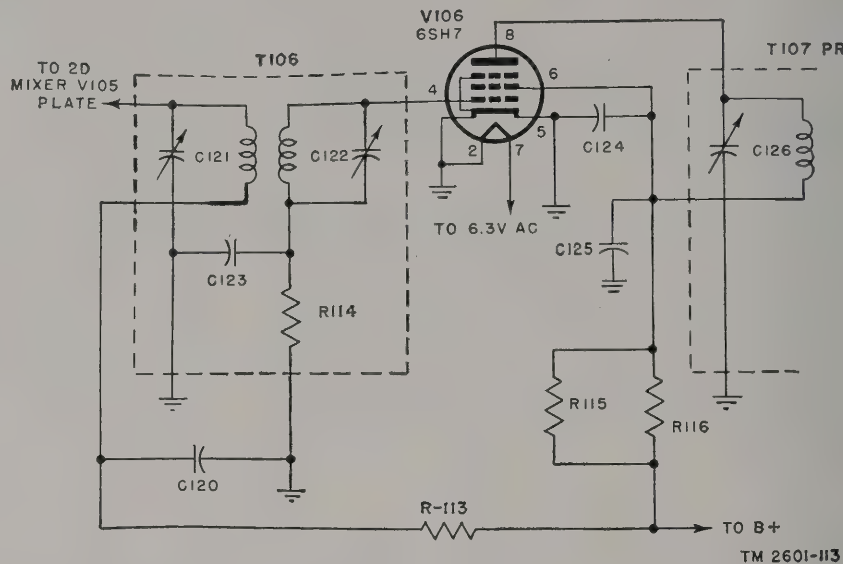


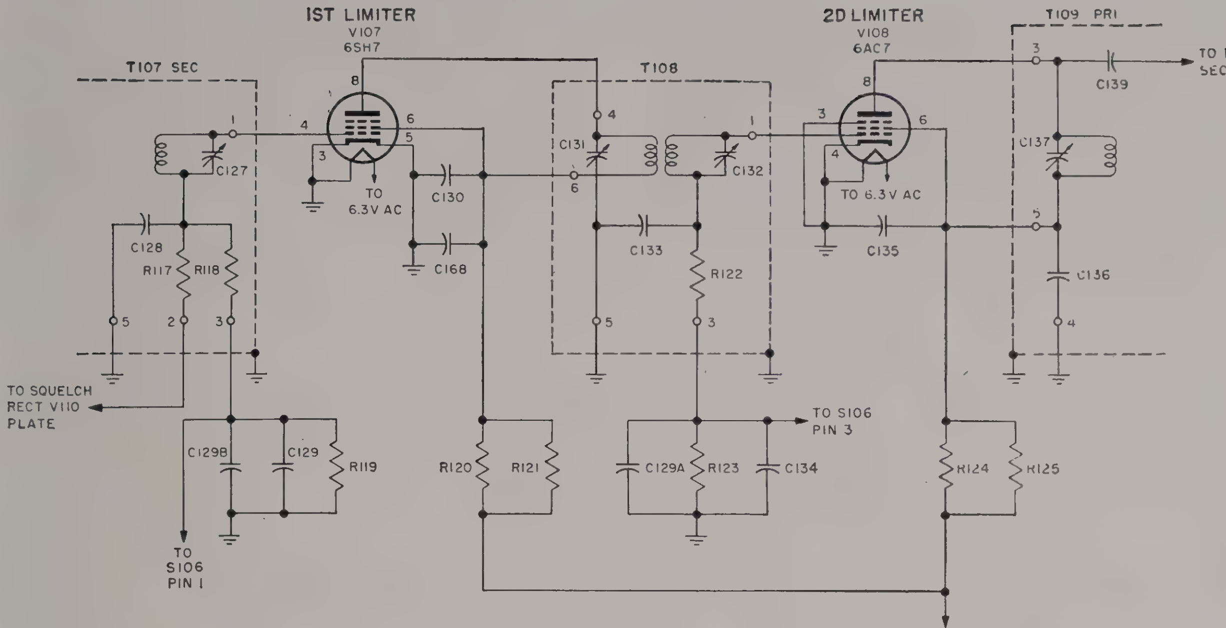
Figure 138. Low i-f amplifier.

204. First and Second Limiters

a. A type 6SH7 tube (V107) is used in the first limiter stage, and a type 6AC7 tube (V108) is used in the second limiter stage (fig. 139). The voltage developed across the secondary of i-f transformer T107 is coupled to the grid of first limiter tube V107. Both tubes V107 and V108 act as current-limiting amplifiers, and the circuits and operation of the two stages are similar. The tubes are operated at low-plate and screen-grid voltages (aproximately 75 volts). No grid bias is used except for that developed by the flow of rectified grid current through grid-bias resistors R118 and R122 in the two stages. These resistors are bypassed for the i.f. (5 mc) by capacitors C128 and C133, respectively. The limiter stages act as a class C amplifier, producing no change in output current or voltage once the impressed grid voltage has exceeded a threshold value of about 2-volts rms (root mean square). Voltages above this value cause an increased amount of rectification in the grid circuit. This automatically sets up an increased value of bias which limits the peak

have little (if any) effect on the circuit. The result will be an f-m signal of constant amplitude. H-f noise voltage, which is amplitude modulated, will be cut off by the limiting action of the tube. By cascading two such limiter stages, the limiting effect of one tube is multiplied by the limiting effect of the other, and thus increased limiting action is obtained. Furthermore, by proper selection of the circuit constants of the first limiter stage, the input to the grid of the second limiter tube V108 is maintained at the optimum value for most effective action. Sufficient gain is incorporated in the receiver so that the smallest incoming signal, equal in value to the noise voltage generated in the grid circuit of the first tube, will cause saturation of the second limiter tube, V108. The first limiter is saturated by minimum signals of 2.5 uv in the antenna circuit.

b. The rectified grid current of the first limiter flows through meter shunt R119 and may be read on the test meter when the METER SWITCH is in position 1 or 2. This current reading may be used for alining all of the preceding stages. The meter shunt resistor R119 is by-



COMPONENT VALUES

COMPONENT	MODEL UNLETTERED, A, B, C, D, E	MODEL H
C127	3-37	3-37
C128	100	100
C129	.05 UF	NOT USED
C129A	NOT USED	.05 UF
C129B	NOT USED	.05 UF
C130	5,000	5,100
C131	3-37	3-37
C132	3-37	3-37
C133	100	100
C134	.05 UF	NOT USED
C135	5,000	5,100
C136	100	100

COMPONENT	MODEL UNLETTERED, A, B, C, D, E	MODEL H
C137	3-37	3-37
C139	25	25
C168	NOT USED	5,100
R117	500K	510K
R118	100K	100K
R119	500	510
R120	50K	24K
R121	50K	NOT USED
R122	100K	100K
R123	200	200
R124	50K	24K
R125	50K	NOT USED

R124 IS 12K IN SOME H MODELS.
C168(5,000) IS USED IN D AND E MODELS.

NOTE
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF

TM 2601-114

Figure 139. Limiter stages.

passed by capacitor C129 (C129B in the H model) to prevent i-f currents from flowing through the meter. Plate and screen-grid voltages are applied to V107 and V108 through filter and voltage-dropping resistors R120 and R121, and R124 and R125, respectively. (The H model does not use resistors R121 and R125.) The plate and screen-grid circuits of V107 and V108 are bypassed to ground by capacitors C130 and C135, respectively. The plate of tube V107 is connected to the primary winding of i-f transformer T108 which is tuned to resonance by trimmer capacitor C131. The secondary winding is tuned by trimmer capacitor C132. The rectified grid current of the second limiter flows through meter shunt R123 and may be read on the test meter when the METER SWITCH is in position 3. This current reading is used for alining the circuits of transformer T108. The output of second limiter tube V108, which is free of amplitude variations, is applied to the primary of discriminator transformer T109. This primary winding is tuned to the i.f. (5 mc) by trimmer capacitor C137. The input for plate 5 of squelch rectifier V110 is taken from the grid end of R118 by resistor R117. R117 isolates the squelch rectifier circuit and prevents disturbance of the V107 grid bias.

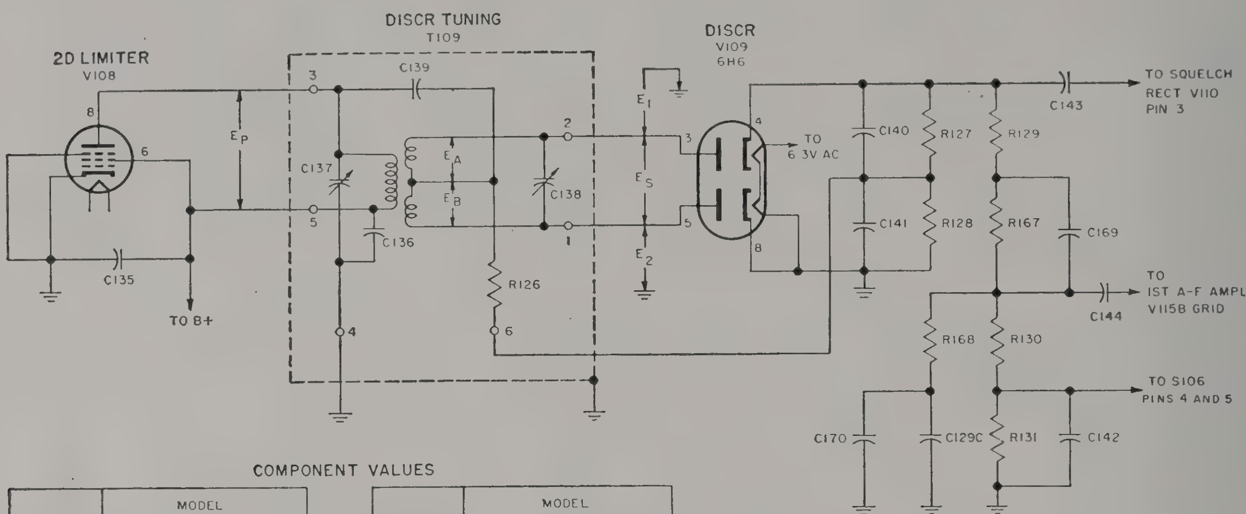
205. Discriminator

a. The discriminator circuit is shown in a functional diagram in figure 140. The purpose of the discriminator stage is similar to that of the detector of the conventional superheterodyne receiver. It converts its input signal into a-f

voltages which are audible in the loudspeaker. As the signal from the limiter stages is of constant amplitude, the audio component of an f-m signal is represented by shifts or *deviations* in frequency. The function of the discriminator is to convert these intermediate frequency variations into a-f voltages so that the resulting a-f current can operate a loudspeaker or some other reproducing device.

a d-c return resistor for the diode circuits.

c. A detailed explanation of the discriminator phase relations follows: First, consider the condition when the output of the i-f amplifier and limiter stages is at the resonant frequency to which both the primary and secondary windings of T109 are tuned. This is the case when the signal being received is not modulated. Voltage E_P (A, fig. 141) exists across the primary



COMPONENT VALUES

COMPONENT	MODEL: UNLETTERED, A, B, C, D, E	MODEL: H
C129C	NOT USED	.05 UF
C135	5000	5100
C136	100	100
C137	3-37	3-37
C138	3-37	3-37
C139	25	25
C140	100	100
C141	100	100
C142	.05UF	.25UF
C143	100	NOT USED
C144	5000	5100

COMPONENT	MODEL: UNLETTERED, A, B, C, D, E	MODEL: H
C169	NOT USED	510
C170	NOT USED	.01UF
R126	20K	20K
R127	100K	100K
R128	100K	100K
R129	100K	100K
R130	10K	10K
R131	5K	5100
R167	NOT USED	22K
R168	NOT USED	10K

R130 IS 20K IN SOME UNLETTERED MODELS.
C143 AND THE LEAD TO V110 IS USED IN THE UNLETTERED MODEL ONLY
C170 IS NOT USED IN ALL H MODELS.

NOTE
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF

TM 2601-115

Figure 140. Discriminator.

b. A duo-diode type 6H6 tube (V109) is used in the discriminator circuit. The primary of discriminator transformer T109 is tuned to resonance at 5 mc by capacitor C137. The secondary of T109 is tuned to the same frequency by trimmer capacitor C138. The primary and secondary windings are coupled both inductively and capacitively; the secondary is center-tapped at a point midway between the two diodes for the capacitive coupling. Load resistors R127 and R128 are equal in value and are bypassed for the intermediate frequency by capacitors C140 and C141, respectively. Resistor R126 is

windings of T109; the primary current I_P lags E_P by nearly 90°. The resulting flux, Ø, which links the secondary winding, is exactly in phase with I_P. Therefore, it also lags E_P by 90°. This flux induces, in the secondary winding of T109, an emf (electromotive force) which drives a current, I_s, through the secondary winding. (This induced voltage is not E_s, the total secondary voltage, which would be measured by a voltmeter connected across the secondary winding, as E_s is the resultant of E_A, E_B, and E_P.) This induced voltage lags the inducing flux, Ø, by 90° and, therefore, lags the primary voltage

E_P by 180° (A, fig. 141). As mentioned before, the secondary circuit is resonated exactly to the i.f. Consequently, the impedance which is presented to the induced voltage is a pure resistance and the resulting current, I_s, is in phase with the induced voltage (A, fig. 141). Now consider voltages E_S, E_A, and E_B. Since the secondary of T109 is a nearly pure inductance, voltage E_S appearing across its terminals will be in quadrature (90° out of phase) with the current I_s through it. But, the two components of E_S, that is, E_A and E_B, are 180° out of phase with each other. (Each is measured with respect to the center tap of the secondary winding.) One of the voltages must lead while the other voltage lags secondary current I_S by 90° as indicated in A, figure 141. Voltage E_P is connected directly to the secondary center tap by C139. The total voltage across the diode connected to pin 3 of tube V109 is made up of E_P in series with E_A; the total voltage across the diode connected to pin 5 of tube V109 is made up of E_P in series with E_B. These total voltages are shown in figure 141–A as E_1 and E_2, respectively. It will be noticed that the magnitude (length) of E_1 and E_2 is the same. Therefore, the d-c output voltage of each diode will be the same but of opposite polarity. The total voltage developed at pin 4 (fig. 140) (cathode end of resistor R127 to ground) will be zero.

and, consequently, secondary current I_s lags the induced voltage. As a result, E_A and E_B are related to E_P as indicated in B, figure 141, and voltages E_1 and E_2 across diode-load resistors R127 and R128 are no longer equal in magnitude and do not cancel out. The voltage E_1 is greater than E_2, so the output from the cathode end of resistor R127 (pin 4) to ground will be positive.

e. When the signal frequency is below resonance, the phase relations are as shown in C, figure 141. The series impedance of the secondary circuit is capacitive and secondary current I_s leads the induced emf with the result shown. E_2 is now greater than E_1, and the output voltage from the cathode end of resistor R127 (pin 4) to ground will be negative.

f. The a-f output of the discriminator appears across the diode load resistors which are caused to vary in potential according to the phase relations existing in the discriminator transformer. The phase relations vary with the modulation and cause the frequency variations to appear as voltage variations across the diodes at different times corresponding to positive or negative cycles of the audio frequency in the modulated wave.

g. The function of the diode load resistors in producing audio voltages from the voltage variations across the diode is explained as follows: When the diode connected to pin 3 of the

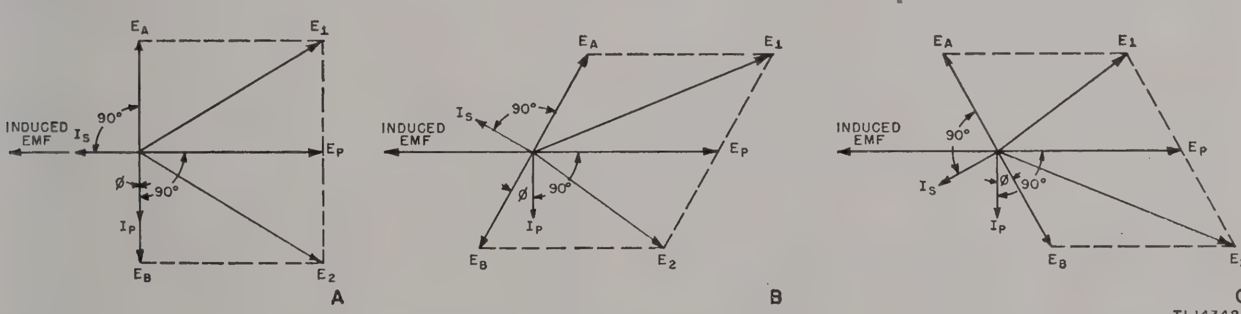


Figure 141. Discriminator phase relations.

d. Assume that the signal frequency is higher than the resonant frequency; the essential phase relations within the discriminator circuit are shown in B, figure 141. The relations of E_P, I_P $\emptyset$, and the induced emf in the secondary are as they were in the case of a resonant signal. However, the impedance presented by the secondary circuit to the induced emf is no longer a pure resistance; it has an inductive component,

discriminator tube is conducting, electrons flow from the plate through the top half of the T109 secondary, resistor R126, and diode load resistor R127 to the cathode. Therefore, the R126, end of resistor R127 will be negative and the cathode end positive. The electron path of the diode connected to pin 5 is from the plate of the tube through the bottom half of the T109 secondary, resistor R126, and diode load resistor

R128 to the cathode. Since the electrons flow down through resistor R128, the top will be negative and the cathode end will be positive. The two negative ends of resistors R127 and R128 are connected together and the positive end of one resistor is connected to ground while the positive end of R127 is connected to the audio output. If the voltages across the two load resistors are equal, the voltage between pin 4 of V109 and ground is zero. If the voltage across resistor R127 is greater, the voltage between pin 4 and ground will be positive. If the voltage across resistor R128 is greater, the voltage between pin 4 and ground is negative.

h. Therefore, when any frequency other than the low intermediate (5 mc) appears at the discriminator, the out-of-phase components applied to the balanced 6H6 discriminator are unbalanced, and a positive or negative resultant voltage appears across resistors R127 and R128. When the r-f voltage across secondary E_A is greater than that across secondary E_B, a greater voltage is developed across R127 making pin 4 positive with respect to ground. This corresponds to the positive audio cycle. When the r-f voltage across secondary E_B is greater than that across secondary E_A, a greater d-c voltage is developed across resistor R128 making pin 4 negative with respect to ground. This corresponds to the negative half of the audio cycle. Therefore, if the r-f voltages across the two diodes vary with the audio frequency in the r-f wave, a-f voltages will be developed between pin 4 and ground. The sign and magnitude of this voltage is determined by the instantaneous frequency of the impressed i-f voltage (different from 5 mc), rather than by its amplitude variations. In this maner, an a-f voltage (varying in amplitude) is derived from the *frequency* variations of the incoming signal. The fact that the resultant d-c output voltage of the discriminator should be zero when a carrier of the correct frequency is impressed on the circuit, provides a useful means of tuning discriminator transformer T109. The METER SWITCH (positions 4 and 5) is connected to the output of the discriminator through isolating resistor R130 so that the necessary adjustments may be made for a zero reading. Resistor R131 acts as a meter shunt and is bypassed by capacitor C142 for i-f and a-f currents. The a-f output of the discriminator is passed through a deemphasis network which consists of resistor R129 (and R167 in the H model) and coupling capacitor C144 (and capacitor C169 in the H model). An additional deemphasis and frequency correction network has been added in the H model. It consists of R168 and capacitors C129C and C170. The deemphasis network reverses the high a-f preemphasis which was applied to the a-f signal in the transmitter for the purpose of giving a better signal-to-noise ratio in the a-f output.

206. First A-F Amplifier

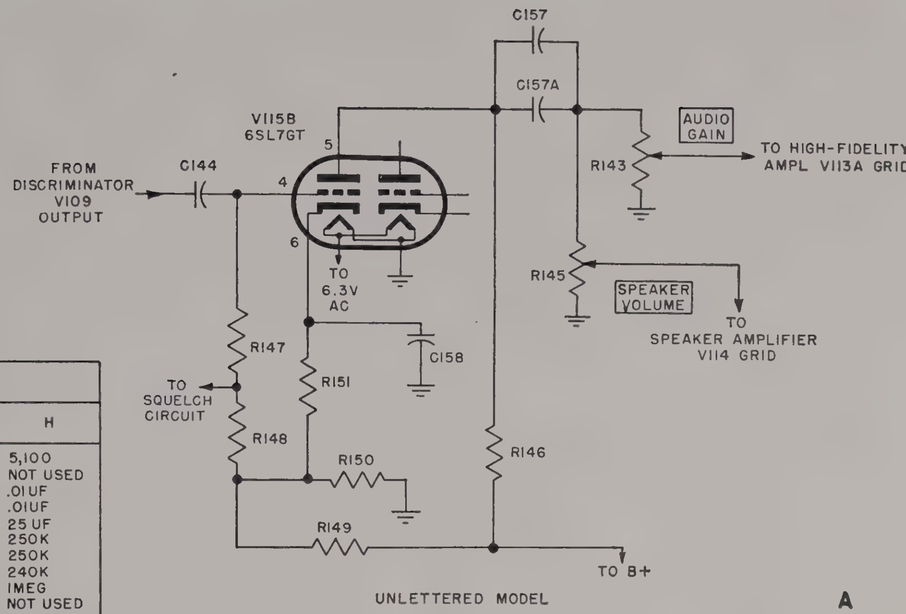
a. The first a-f amplifier is shown in the functional diagram in figure 142. One triode of a dual-triode type 6SL7GT tube (V115B) is used as the first a-f amplifier stage. The a-f output from the discriminator is coupled to the grid of tube V115B by capacitor C144. R147 is the grid-return resistor. Cathode-bias resistor R151 is bypassed to ground for a-f currents by capacitor C158. Plate voltage is supplied through plate-load resistor R146. The amplified a-f output of tube V115B is applied to two potentiometers, R143 and R145, which feed the high-fidelity and speaker-amplifier stages, respectively.

b. The first a-f amplifier of the unlettered model is shown in a functional diagram in A, figure 142. The lower section of grid return resistor R147 is connected to the B+ circuit through R148 and R149 and to the ground through R148 and R150. R148 is also the squelch amplifier (V115A) plate load. The lower section of cathode resistor R151 is connected to the B+ circuit through R149 and to the ground through bleeder resistor R150. Capacitor C157A is conected in parallel with coupling capacitor C157 in the unlettered model. Resistors R148 through R150 are in the squelch amplifier plate circuit in the A through H models, but are not connected to the a-f amplifier. The remainder of the first a-f amplifier circuit in the unlettered model is the same as the circuit in the lettered models (B, fig. 142).

c. In the H model, the output coupling capacitor is composed of two parallel units, C157A and C157B.

207. High-Fidelity Amplifier Circuits

a. One triode section of a type 6SN7GT tube (V113A) is used as the high-fidelity a-f ampli-



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED	A,B,C,D,E	H
C144	5,000	5,000	5,100
C157	.01 UF	.02 UF	NOT USED
C157A	.01 UF	NOT USED	.01 UF
C157B	NOT USED	NOT USED	.01 UF
C158	25 UF	25 UF	25 UF
R143	250K	250K	250K
R145	250K	250K	250K
R146	250K	250K	240K
R147	1MEG	1MEG	1MEG
R148	250K	NOT USED	NOT USED
R149	40K	NOT USED	NOT USED
R150	20K	NOT USED	NOT USED
R151	5K	2K	2K

R148, R149, AND R150 ARE USED AS THE SQUELCH AMPLIFIER PLATE LOAD IN THE A THROUGH H MODELS, BUT ARE NOT IN THE AUDIO CIRCUIT.

NOTE:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

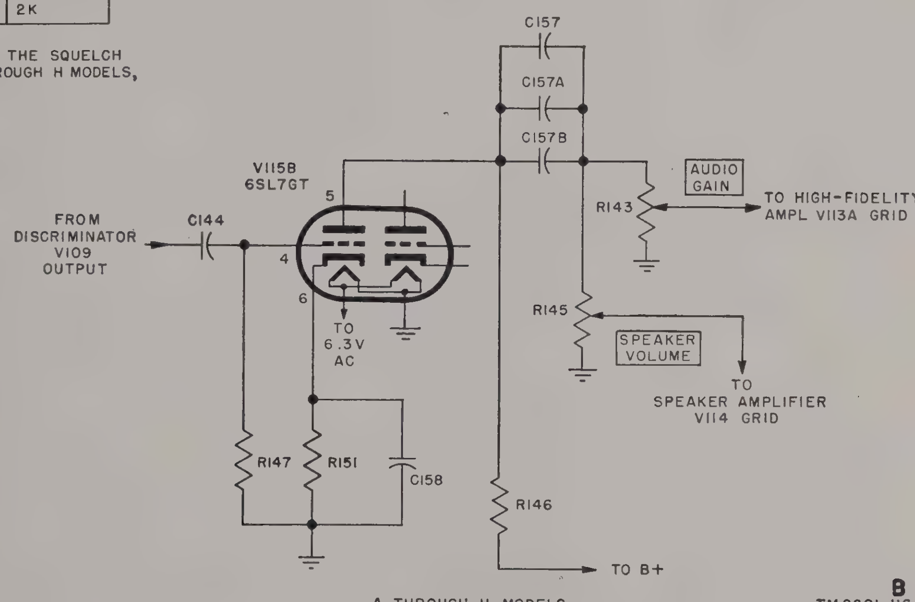


Figure 142. First a-f amplifier.

fier (A, fig. 143). The output of first a-f amplifier tube V115B is applied across R143, and the arm of AUDIO GAIN control R143 is connected directly to the grid of tube V113A. Cathode biasing resistor R142 is bypassed for a-f voltages by capacitor C155. Operating plate voltage is fed to the tube through the primary winding of a-f output transformer T112. This transformer matches the plate impedance of tube V113A to the 500-ohm output circuit. The 500-ohm output winding is center-tapped for use in simplexing circuits (par. 191*e*). The 500-ohm output circuit is connected to pins A and C of cable connector P103, and to RECEIVER OUTPUT terminals P104 and P105, located on the front panel of Radio Receiver R–19(*)/TRC–1. From connector P103, the high-fidelity audio output is fed through connecting Cord CX–104/TRC–1 to the REC. terminals on the top left of the front panel of Radio Transmitter T–14(*)/TRC–1. Low-pass filter T117 may be cut in or out of the high-fidelity circuit by means of

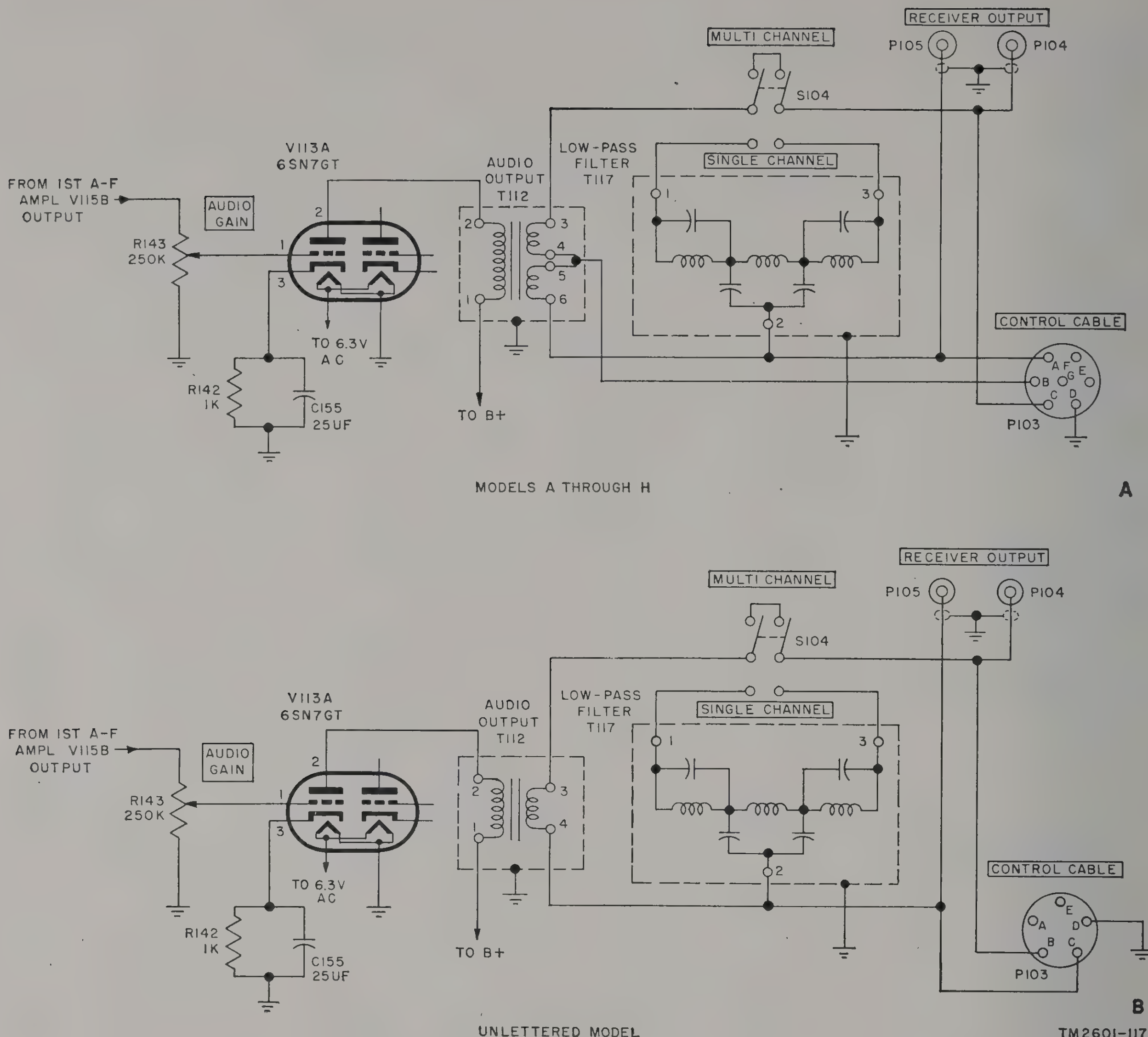


Figure 143. High-fidelity audio amplier.

MULTICHANNEL - SINGLE CHANNEL switch S104 on the front panel of the receiver. When this switch is in the SINGLE CHANNEL position, low-pass filter T117 is inserted in the audio-output line and cuts off all audio frequencies above 3,000 cycles.

b. The high-fidelity amplifier circuit of the unlettered model (fig. 143–B) differs in several respects from the A through H models. Audio output transformer T112 is not center-tapped for simplexing facilities. The audio output is connected to pins B and C of the CONTROL CABLE plug instead of A and C as in the lettered models.

208. Speaker Amplifier

a. A type 6V6GT tube (V114) is used as the speaker amplifier (fig. 144). The arm of SPEAKER VOLUME control R145 is connected directly to the grid of tube V114. Cathode biasing resistor R144 is bypassed for a-f voltages by capacitor C156. Operating plate voltage is fed to the tube through the primary winding of a-f transformer T115. This transformer matches the plate impedance of tube V114 to 500-ohm low-pass filter T114. This filter has a cut-off frequency of approximately 3,000 cycles and separates channel 1 from the three carrier telephone channels for direct voice communica-

COMPONENT VALUES

COMPONENT	MODEL	
	UNLETTERED, A, B, C	D, E, H
C156	25 UF	25 UF
R141	7,500	NOT USED
R144	1K	500
R145	250K	250K
R155	1K	NOT USED
R164	NOT USED	6

R141 IS CONNECTED FROM RELAY AMPL CATHODE TO GROUND IN THE D, E, AND H MODELS.
IN THE H MODEL, R144 IS 510 AND R164 IS 6.3

NOTE:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

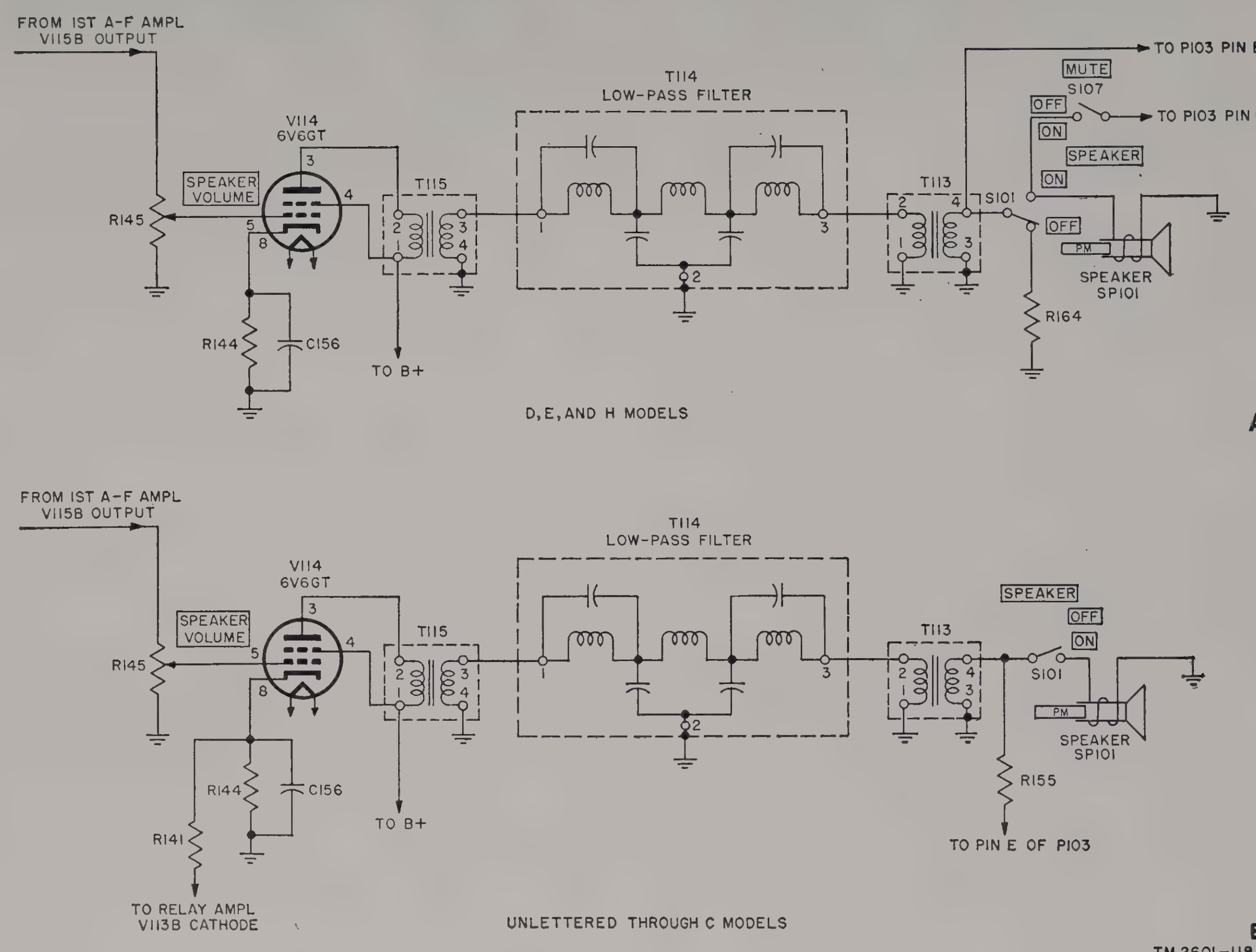


Figure 144. Speaker amplifier.

tion purposes. The output of filter T114 is coupled to the loudspeaker voice coil through matching transformer T113. Switch S101 opens the loudspeaker circuit. Resistor R164 (not used in the unlettered through C models) across transformer T113 prevents excessive increase in the handset receiver level when the speaker load is removed from the output circuit. Audio voltage for actuating the handset receiver is taken from the loudspeaker voice-coil circuit and is fed through connector P103 and interconnecting Cord CX–104/TRC–1 (or Cord CX–8/TRC–1) to Radio Transmitter T–14(*)/TRC–1. It terminates in HEADSET jack J2 on the transmitter front panel. The MUTE ON-OFF switch (in the D, E, and H models) is used in conjunction with the antenna relay in the transmitter (RL1) to ground the speaker output when transmitting.

b. In the unlettered, A, B, and C models, resistor R141 is connected to the cathode of tube V114 to obtain voltage to actuate relay amplifier tube V113B which operates the carrier-operated relay. Resistor R164 and MUTE ON-OFF switch S107 are not incorporated in these models. In the unlettered through C models SPEAKER ON-OFF switch S101 is single-pole, single-throw; in the D, E, and H models it is single-pole, double-throw.

209. Squelch and Carrier-Operated Relay Circuits (A through H Models)

The squelch and carrier-operated relay circuits for the A, B, C, D, E, and H models are shown in the functional diagram in figure 145.

a. The squelch and carrier-operated relay circuits incorporated in the receiver have two purposes: first, to silence the normal high noise level output of the f-m receiver during periods when no signal is being received, and second, to permit the transmitter to be turned on automatically when an r-f carrier is received so that the signal can be retransmitted for relay operation, as for example, when the set is being used as part of Radio Relay Set AN/TRC–4(*). These functions are performed by carrier-operated relay RL101.

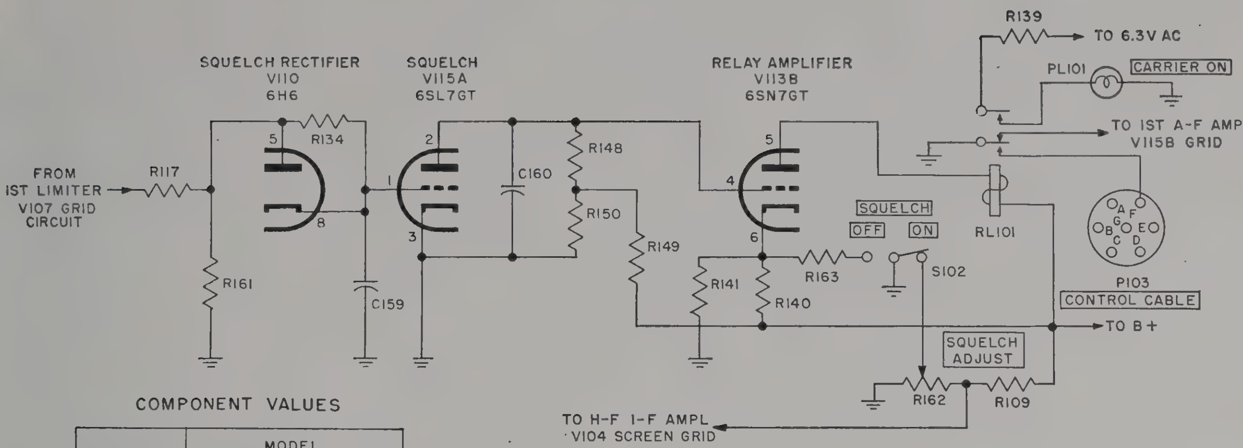
b. Relay RL101 is in the plate circuit and is energized by the plate current of one section of a type 6SN7GT tube (V113B). V113B is controlled by squelch amplifier tube V115A (a type 6SL7GT), which in turn is controlled by a received signal in the following manner:

(1) When an r-f carrier is received, an r-f voltage appears at the grid of first limiter tube V107. The r-f signal is rectified in the grid circuit of V107, generating a negative voltage across R118 (fig. 139). A portion of this voltage is selected from the voltage divider consisting of R117 and R161; this portion is fed through a noise-limiting circuit consisting of R134, C159, and diode V110 (a type 6H6 tube). The negative voltage, after going through V110 and R134, is applied to the grid of squelch tube V115A. This causes plate current cut-off in V115A. Since there is no plate current through R148, the plate assumes the positive potential (about 65 volts) existing at the junction of the voltage divider which consists of R149 and R150.

(2) The grid of relay amplifier tube V113B is connected to the plate of tube V115A and must assume the same potential. The cathode of V113B is held at a positive potential (about 70 volts) by the voltage divider consisting of R140 and R141. Since the grid of tube V113B is at only a 5-volt negative potential with respect to the cathode, plate current flows and relay RL101 becomes energized, removing the ground from the grid of audio-amplifier tube V115B and permitting the receiver to function normally.

c. With no signal or with a weak signal present, insufficient negative voltage is generated in the first limiter (V107) grid circuit to cause plate current cut-off of tube V115A. Because of the plate current flow through R148, the voltage drop across R149 is greater and the plate of tube V115A assumes a voltage near ground potential. This in turn makes the grid of tube V113B negative with respect to its cathode and causes the plate current in that tube to decrease, deenergizing relay RL101. In the deenergized position, the relay contacts ground the audio grid of tube V115B and disable the receiver.

d. The signal level at which relay action takes place is determined by the voltage recti-



COMPONENT VALUES

COMPONENT	MODEL	
	A,B,C,D,E	H
C159	.1UF	1UF
C160	.05 UF	NOT USED
R109	75K	75K
R117	500K	510K
R134	5 MEG	5.1 MEG
R140	40K	39K
R141	7,500	10K
R148	250K	240K
R149	40K	39K
R150	20K	20K
R161	500K	150K
R162	100K	100K
R163	2K	2K

NOTE.
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

R141 IS CONNECTED TO THE SPKR AMPL V114 CATHODE INSTEAD OF GROUND IN THE A MODEL.
R141 IS 10K IN THE D AND E MODELS.
C159 IS COMPOSED OF C159A AND C159B (.05UF EACH) IN THE H MODEL.
C160 IS REPLACED BY C159C (.05UF) IN THE H MODEL.

TM2601-119

Figure 145. Squelch and carrier-operated relay circuits in A through H models.

fied in the first limiter grid circuit. This is dependent on the strength of the received signal and the gain of the receiver ahead of the first limiter. The gain is controlled (when SQUELCH ON-OFF switch S102 is in the ON position) by variable resistor R162. R162 has a screwdriver adjustment from the front panel labeled SQUELCH ADJUST. This resistor varies the gain by varying the screen voltage on first i-f amplifier V104. When SQUELCH ON-OFF switch S102 is in the OFF position, this control is not effective and the gain is returned to maximum. The received signal strength at which the relay will function can be adjusted over a range of approximately 2 to 500 uv.

e. Carrier-operated relay RL101 has two other functions. One pair of contacts lights the red pilot lamp, PL101, marked CARRIER ON, on the front panel when the relay is energized. Voltage-dropping resistor R139 reduces the brilliance of pilot lamp PL101 and prevents excessive burnouts of the lamp by limiting the starting current. (Bulbs have a low resistance when cold; therefore, they draw a large initial current.) A second pair of contacts grounds (when properly connected) the coil circuit of relay RL1 in associated Radio Transmitter T–14(*)/TRC-1 through contact F of cable connector P103 and inter-connecting Cord CX–104/TRC–1. The transmitter carrier is thus automatically turned on whenever a signal is being receiver above the level at which the SQUELCH ADJUST control is set.

f. In the unlettered through C models, the cathode of tube V113B is held at a positive potential by the voltage drop across cathode resistor R144 of speaker amplifier tube V114 as well as the voltage drop obtained across the voltage divider consisting of R140 and R141.

210. Squelch and Carrier-Operated Relay Circuits (Unlettered Model)

a. Squelch Circuit. The squelch and carrier-operated relay circuits of the unlettered model are shown in the functional diagram in figure 146.

(1) The first triode section of a type 6SL7GT tube (V115A) is used to disable first a-f amplifier tube V115B when no carrier is being received. The actuating voltages for the squelch circuit are obtained from two sources. One is the rectified grid current in the first limiter stage, the value of which is dependent on signal strength or noise level. The other is the high-frequency audio component present in the output of the discriminator. This component is dependent only on the signal-to-noise ratio.

operate the squelch circuit and cause noise to be be heard in the loud-speaker. R134 is a high resistance, causing capacitors C145 and C159 to charge slowly so that the voltage across them will not rise appreciably during a burst of noise. Diode V110A is not active during this phase of operation, since its plate is negative with respect to its cathode. As soon as the noise peak has passed, however, the peak negative voltage generated across resistor R118 in the limiter grid circuit disappears and the diode (V110A) plate

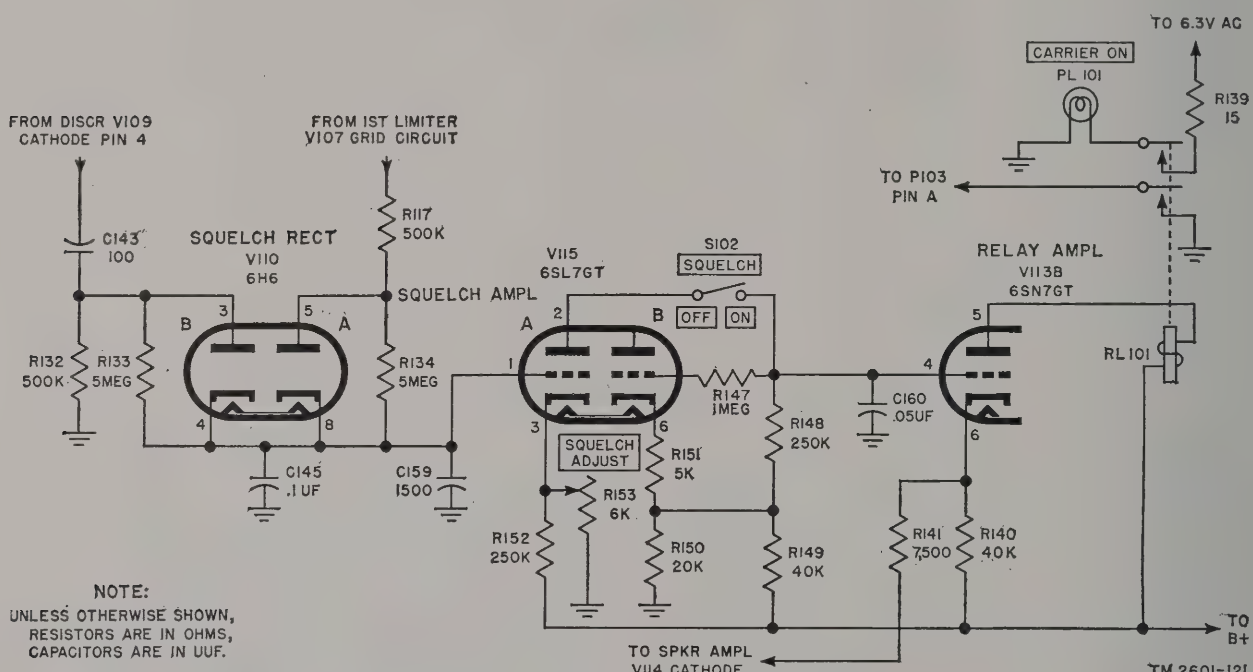


Figure 146. Squelch and carrier-operated relay circuits of unlettered model.

(2) The negative voltage developed across grid resistor R118 (fig. 139) by the rectified grid current of first limiter tube V107, is applied to the grid of squelch tube V115A through isolating resistors R117 and R134. Resistor R134 is shunted by the diode type 6H6 tube V110A which eliminates the rectified noise voltages in the limiter grid circuit. Noise bursts are rectified in the limiter grid circuit causing peaks of negative voltage across resistor R118. These negative peaks, if transmitted to the squelch tube, would momentarily

becomes positive with respect to its cathode and negatively charged capacitors C145 and C159. Under this condition, the diode acts as a low resistance and quickly discharges capacitors C145 and C159 through resistors R117 and R118 to the ground. In this way, the circuit is restored to its initial condition in preparation for further noise peaks. A constant carrier, on the other hand, causes a steady negative rectified voltage to be applied to the grid of V115A to actuate the squelch circuit.

(3) H-f noise components present in the output of the discriminator are coupled into the squelch circuit by capacitor C143 and are rectified by the other diode of the type 6H6 tube (V110B). When noise peaks of positive polarity are developed across resistor R133, diode V110 conducts and applies a small positive potential to the grid of squelch tube V115A. Under stand-by or no-signal conditions the noise rectified in the grid circuit of the first limiter tube tends to bias the grid of tube V115A negatively, as explained in (2) above. The rectified h-f noise pulses present in the output of the discriminator tend to bias the grid of tube V115A in a positive direction. These two voltages balance each other under any noise conditions since an increase or decrease in the noise level causes like changes in both opposing voltages. The circuit constants are selected so that the grid of tube V115A will be slightly positive with respect to ground. The cathode of tube V115A is also maintained at a voltage slightly positive with respect to ground. The slightly positive voltage is maintained by bleeder resistor R152 and SQUELCH ADJUST resistor R153. R153 is set so that tube V115A starts to conduct under no-signal conditions.

(4) The cathode of first a-f amplifier tube V115B is also held positive with respect to ground by the voltage divider arrangement (A, fig. 142), which consists of resistors R149 and R150, but is at a considerably higher potential than that of the cathode of tube V115A. With tube V115A conducting, a voltage drop will occur across resistor R148, which biases the grid of tube V115B to beyond the cut-off point and blocks the audio output. However, when a signal is received, more negative voltage is developed in the first limiter grid circuit. At the same time, the noise-eliminating properties of the f-m receiver result in less noise output from the discriminator and less positive voltage applied to the grid of tube V115A. These changes are aiding in polarity and cause the potential on the grid of V115A to go negative to such an extent that the tube stops conducting. With no drop in potential across resistor R148, the grid of tube V115B assumes the potential existing at the junction of resistors R148, R149, and R150, and tube V115B resumes operation as an a-f amplifier. Switch S102 in the plate circuit of tube V115A is used to make the receiver operative for alinement and servicing. It is also used when squelch operation is not desired. The squelch circuit is adjusted by means of resistor R153 so that a continuous signal of approximately 1 uv on the antenna causes the receiver first a-f amplifier to operate. Noise peaks of high intensity are not heard in the absence of a carrier.

b. Carrier-Operated Relay. Carrier-operated relay RL101 is energized by the plate current of one triode section of a type 6SN7GT tube (V113B). The grid of V113B is connected to the squelch circuit in the same manner as first a-f amplifier tube V115B. Hence, when a carrier is received, the negative bias is removed from the grid of relay amplifier tube V113B, and plate current flows, energizing the relay coil. There are two sets of make contacts on relay RL101. One pair lights the red pilot lamp on the front panel marked CARRIER ON. The other pair is used to complete the coil circuit of relay RL1 in associated Radio Transmitter T–14/TRC–1 through the interconnecting Cord CX–8/TRC–1. This connection turns on the transmitter carrier.

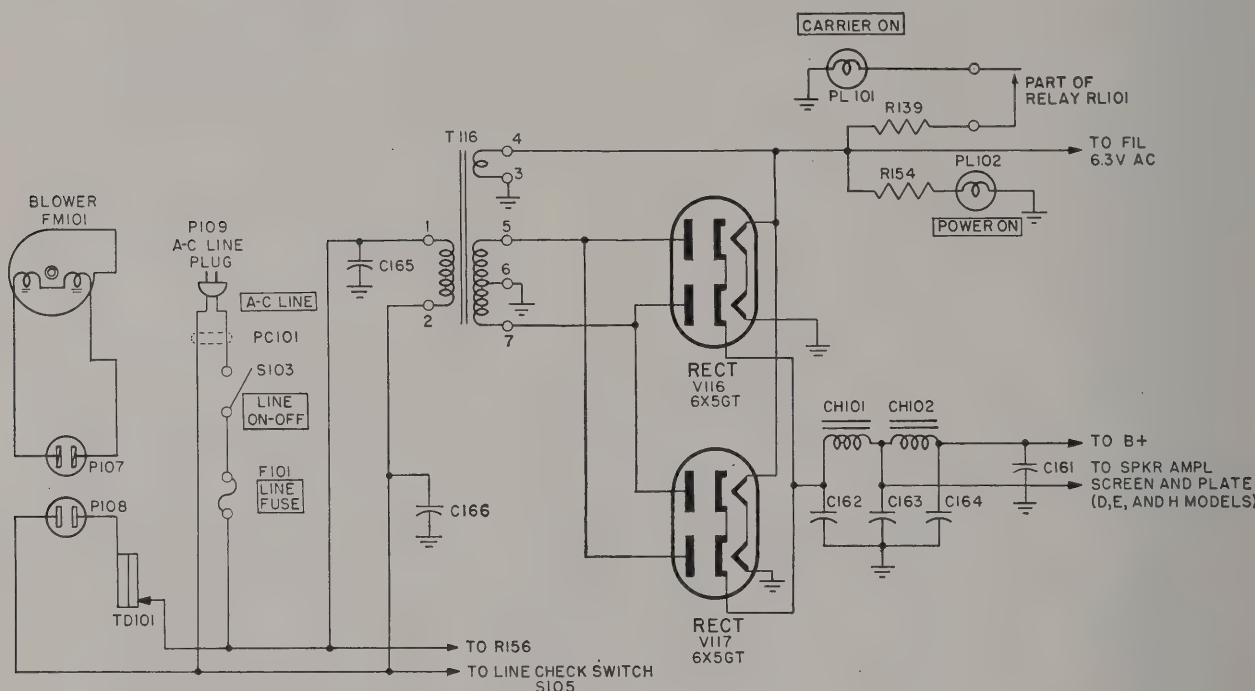
211. Power Circuits
(fig. 147)

a. The receiver operates from a 115-volt, 50- to 60-cycle, a-c source. Power is fed into the receiver through a-c line cord PC101, which enters the lower left corner of the front panel, and LINE FUSE F101, which is also available from the front panel. All power input is controlled by LINE ON-OFF switch S103. Power transformer T116 has two secondary windings. The first supplies all vacuum-tube heaters and pilot light filaments. The POWER ON filament

(green) pilot lamp PL102 lights when transformer T116 is energized. The second winding supplies high voltage ac at a potential of approximately 245 volts to the plates of full wave rectifier tubes type 6X5GT, V116 and V117. The output of the rectifier is filtered by capacitors C162, C163, and C164 and chokes CH101 and CH102 to produce substantially pure d-c power at a potential of approximately 250 volts for plates and screens of all tubes.

b. Fan motor FM101 is energized from the 115-volt line through thermostat TD101, which turns the fan on at approximately 85° F. and turns it off at approximately 75° F.

c. R-f noise on the incoming a-c line is bypassed to ground through capacitors C165 and C166. Resistors R139 and R154 limit the filament currents in the CARRIER ON and POWER ON indicating bulbs. Capacitor C161 is an r-f bypass on the B+ lead.



COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED	A,B,C,	D,E,H
C161	1,500	1,500	1,500
C162	10 UF	10 UF	20 UF
C163	10 UF	10 UF	20 UF
C164	20 UF	20 UF	40 UF
C165	1,500	1,500	1,500
C166	1,500	1,500	1,500
F101	2 A	2 A	2 A
R139	15	15	15
R154	15	15	15
V116	6X5GT	6X5GT	6X5GT
V117	NOT USED	6X5GT	6X5GT

IN THE H MODEL, C162 IS REPLACED BY C162A, C163 IS REPLACED BY 162B, AND C164 IS COMPOSED OF TWO 20UF SECTIONS, C164A AND C164B.

NOTE:
UNLESS OTHERWISE SHOWN;
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

TM 2601-122

Figure 147. Power supply.

d. In the unlettered model, the primary power is brought in through a-c line connector P102 instead of the line cord connected permanently to the set. Only one rectifier tube (V116) is used. A second rectifier tube may be added by authority of an MWO.

212. Metering Circuits
(fig. 148)

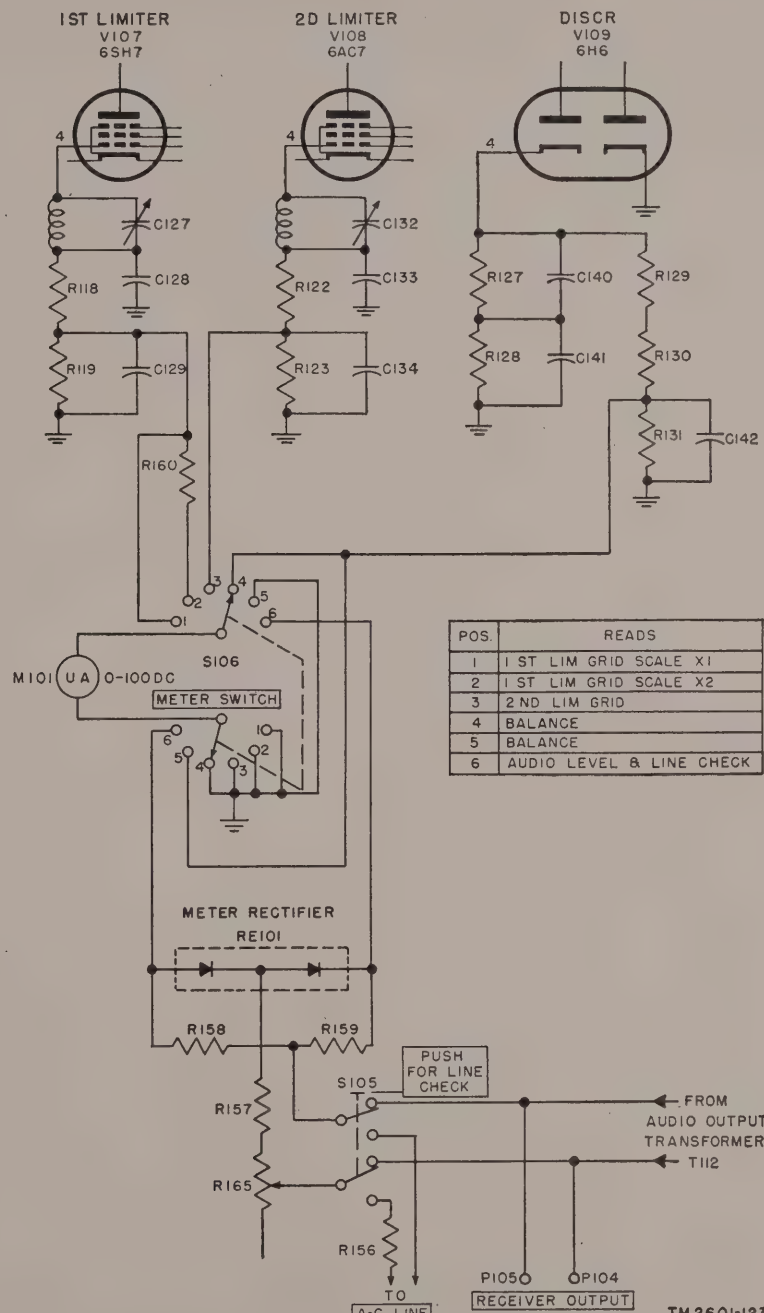
a. Six-position METER SWITCH S106 connects 0- to 100-microampere meter M101 into the various receiver circuits to facilitate tuning and operation of the receiver. With the METER

COMPONENT VALUES

COMPONENT	MODEL		
	UNLETTERED, A,B,C	D,E	H
C128	100	100	100
C129	.05UF	.05UF	.05UF
C133	100	100	100
C134	.05UF	.05UF	.05UF
C140	100	100	100
C141	100	100	100
C142	.05UF	.05UF	25UF
R118	100K	100K	100 K
R119	500	500	510
R122	100K	100K	100 K
R123	200	200	200
R127	100K	100K	100 K
R128	100K	100K	100 K
R129	100K	100K	100 K
R130	10K	10K	10 K
R131	5K	5K	5,100
R156	620K	640K	620 K
R157	3K	1,500	1,500
R158	3K	3K	3 K
R159	3K	3K	3K
R160	2K	2K	2K
R165	NOT USED	2K	2K

R130 IS 20K IN SOME UNLETTERED MODELS.
IN THE H MODEL, C129 IS C129B AND C134 IS C129A.

NOTES:
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.



POS.	READS
1	1 ST LIM GRID SCALE X1
2	1 ST LIM GRID SCALE X2
3	2 ND LIM GRID
4	BALANCE
5	BALANCE
6	AUDIO LEVEL & LINE CHECK

Figure 148. Metering circuits.

SWITCH in position 1, the meter reads the first limiter grid current. The first limiter grid current on strong signals causes the meter to go off scale. The METER SWITCH position 2, however, doubles the current indicating range of the meter by means of multiplying resistor R160. In position 3, the METER SWITCH connects meter M101 into the second limiter grid circuit. Positions 4 and 5 are used for reading the off-balance current in the discriminator circuit. The two latter positions are the same except for reversed meter polarity, so that in either position an up-scale meter reading may be had regardless of the polarity of the current from the discriminator circuit. With the METER SWITCH in position 6, the meter is connected to the output of rectifier RE101 which, in conjunction with multiplying resistors R157, R158, R159, and R165, provides metering of the a-f voltages present in the high-fidelity audio output circuit.

b. Resistor R165 is used to compensate for inaccuracy due to aging of the rectifier, and R158 and R159 act as the load for rectifier RE101. When LINE CHECK switch S105 is depressed, this same meter-rectifier combination is placed in series with multiplying resistor R156 across the a-c line. This permits a line voltage reading on meter M101. In the unlettered through C models, resistor R165 is not used.

Section III. THEORY OF AMPLIFIER AM–8(*)/TRA–1 AND POWER SUPPLY PP–13(*)/TRA–1

213. General Characteristics of Amplifier AM–8(*)/TRA–1

Amplifier AM–8(*)/TRA–1 is designed to amplify the output of Radio Transmitter T–14(*)/TRC–1 to approximately 250 watts. This is done in a single-stage Class C amplifier utilizing two power pentode type 4E27 tubes. The use of pentodes eliminates the need for neutralizing adjustments and provides full 250-watt output with only a portion of the transmitter output needed for drive. A combination of fixed and grid-leak bias provides stable operation under all conditions. A schematic diagram of Amplifier AM–8(*)/TRA–1 is given in figure 149. Amplifier AM–8(*)/TRA–1 obtains all of its operating power from Power Supply PP–13(*)/TRA–1.

214. Control-grid Circuit

The output of Radio Transmitter T–14(*)/TRC–1 is fed into Amplifier AM–(*)/TRA–1 through coaxial cable connector P201 (R–F INPUT). A section of concentric transmission line transfers the energy to a tuned grid circuit which consists of L202 and C201. The r-f energy is transferred by means of a one-turn coupling coil, L201. Capacitor C210 tunes coupling coil L201 approximately to resonance. Grid coil L202 is tuned to resonance by split-stator capacitor C201 which can be adjusted from the front panel (GRID TUNING) through a worm-gear drive. Bias for Class C operation is obtained from two sources, each contributing approximately half of the required operating bias voltage. Fixed bias of about 100 volts potential is furnished by Power Supply PP–13(*)/TRA–1. During the absence of r-f drive, this bias is sufficient to practically cut off plate and screen current in amplifier tubes V201 and V202. Additional bias is obtained under normal drive conditions from the grid leak and capacitor combinations R201 and C202 and R202 and C203. Individual grid leaks are used in each grid circuit to balance automatically any inequalities in drive or tube characteristics.

215. Screen-grid Circuit

The screen grids of tubes V201 and V202 are bypassed at the sockets by capacitors C206 and C207. Screen-grid voltage is supplied from the high-voltage supply in Power Supply PP–13(*)/TRA–1 by voltage-dropping resistor R303 (fig. 150). The voltage at the screen terminals is kept at 450 volts by three voltage regulator type OD3 tubes (V203, V204, and V205). These are connected in series between the screen grids and ground. Without this regulator arrangement, it would be difficult to reduce the plate and screen currents to a low value during stand-by periods of no r-f drive. Bleeder resistor R204, connected between the

screen grids and ground, helps to maintain uniform screen voltage.

216. Plate Circuit

Plate circuit inductor L203 of the push-pull amplifier is tuned to resonance by split-stator capacitor C208. Capacitor C208 can be tuned from the front panel (PLATE TUNING control) through a worm-gear drive. Plate voltage is applied at the center tap of L203 through r-f choke L205.

217. Antenna Coupling Circuit

The r-f output of the amplifier is inductively coupled to the antenna transmission line by means of coupling coil L204. The inductive reactance of this coil and the associated wiring is resonated by capacitor C209. This capacitor is tuned from the front panel (ANTENNA LOADING) and acts as an antenna loading adjustment. The output is fed through antenna transfer relay RL201 to coaxial connector P203 (ANTENNA).

218. Power and Control Circuits

a. POWER CIRCUITS. Filament power for two amplifier tubes V201 and V202 is obtained from filament transformer T201, which operates directly from the 115-volt, 60-cycle power source. Capacitors C204 and C205 bypass the filaments (for r-f voltage) at the tube sockets. All power for operation of the amplifier is obtained from Power Supply PP–13(*)/TRA–1 through the power cord and POWER CABLE receptacle P204 on the front panel of the amplifier and through the h-v cable and receptacle,

COMPONENT VALUES

COMPONENT	MODEL				
	UNLETTERED	A	B	C	D,E
C201	DUAL 3-50	DUAL 3-50	DUAL 3-50	DUAL 3-50	DUAL 3-50
C202	5000	5000	5000	5000	5100
C203	5000	5000	5000	5000	5100
C204	5000	5000	5000	5000	5100
C205	5000	5000	5000	5000	5100
C206	2000	2000	2000	2000	2000
C207	2000	2000	2000	2000	2000
C208	DUAL 6-30	DUAL 7-35	DUAL 7-35	DUAL 7-35	DUAL 7-35
C209	5-50	5-50	5-50	5-50	5-52
C210	25	25	25	25	24
C211	2000	2000	2000	2000	2000
R201	10K	10K	10K	10K	10K
R202	10K	10K	10K	10K	10K
R203	.22	.15	.167	.167	.24
R204	500K	500K	500K	500K	510K
R205	600	600	600	600	630
R206	2 8	2 25	2 5	3.7	5.49
R207	1K	1K	1K	1K	1K
R208	200K	200K	200K	200K	200K
R209	200K	200K	200K	200K	200K
R210	200K	200K	200K	200K	200K
R211	200K	200K	200K	200K	200K
R212	200K	200K	200K	200K	200K
R213	600	600	600	600	630

NOTE
UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

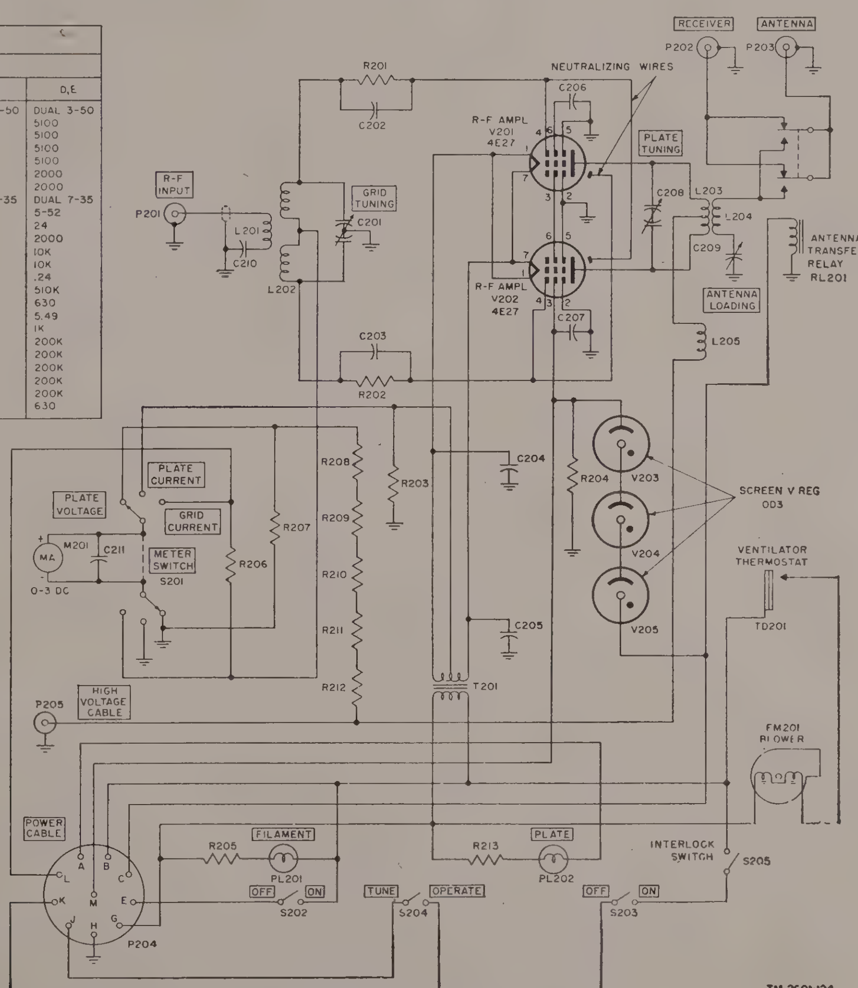


Figure 149. Amplifier AM–8(*)/TRA–1, schematic diagram.

P205. Primary power enters through Power Supply PP–13(*)/TRA–1 directly through the interconnecting cable to the amplifier which has all control functions. Filament ON-OFF switch S202, when in the ON position, completes the primary power circuit to both the filament transformer in the amplifier and the filament and bias supplies in Power Supply PP–13(*)/TRA–1. The green FILAMENT pilot lamp, PL201, is energized through voltage-dropping resistor R205. Blower FM201 is energized whenever the chassis temperature rises to 85° F., causing thermostat TD201 to complete the motor circuit. Bias voltage is fed through the interconnecting cable to the amplifier. When plate ON-OFF switch S203 is thrown ON, the h-v section in the power supply is energized. Plate and screen voltages are supplied to the amplifier, and at the same time voltage is supplied to red PLATE pilot lamp PL202 through voltage-dropping resistor R213. A primary lead to h-v transformer T302 (in the power supply) is opened when interlock switch S205 is operated by opening the amplifier cover.

b. Antenna Transfer Relay. The amplifier is in the stand-by condition with the filament and plate power applied but with no r-f input. The antenna transfer relay RL201 is in the h-v return circuit of the power supply. With no r-f input, the tubes are biased nearly to cut-off and little plate current flows, leaving relay RL201 de-energized. In this condition, the antenna is connected from ANTENNA connector P203 through the antenna transfer relay to RECEIVER connector P202 on the front panel. One antenna can thus be used for both transmitting and receiving during simplex operation. When the radio transmitter is energized and delivers r-f energy to the grids of the amplifier tubes, V201 and V202, the plate current of the tubes rises to normal and energizes relay RL201. This transfers the antenna connection to the r-f output circuits of the amplifier.

c. Tune Operate Switch. TUNE OPERATE switch S204, located on the front panel of the amplifier, provides lowered plate and screen voltages when in the TUNE position. This is accomplished by inserting a dropping resistor (R304, fig. 150) in series with the primary of the plate transformer in the power supply to limit the input power applied to that unit.

d. Metering Circuits. Panel meter M201 and METER SWITCH S201 are used to measure the grid and cathode currents as well as the plate voltage. With the METER SWITCH in the GRID CURRENT position, the combined grid currents of tubes V201 and V202 are read across meter shunt resistor R206, which is in series with the grid d-c return. With the METER SWITCH in the PLATE CURRENT position, the combined cathode currents of tubes V201 and V212 are read across meter shunt resistor R203, which is connected between the filament transformer center tap and ground. With the METER SWITCH in the PLATE VOLTAGE position, meter M201 reads the plate voltage. H-v meter-multiplier resistors R208 through R212 and meter shunt R207 are used for the plate voltage measurement.

219. Power Supply PP–13(*)/TRA–1 (fig. 150)

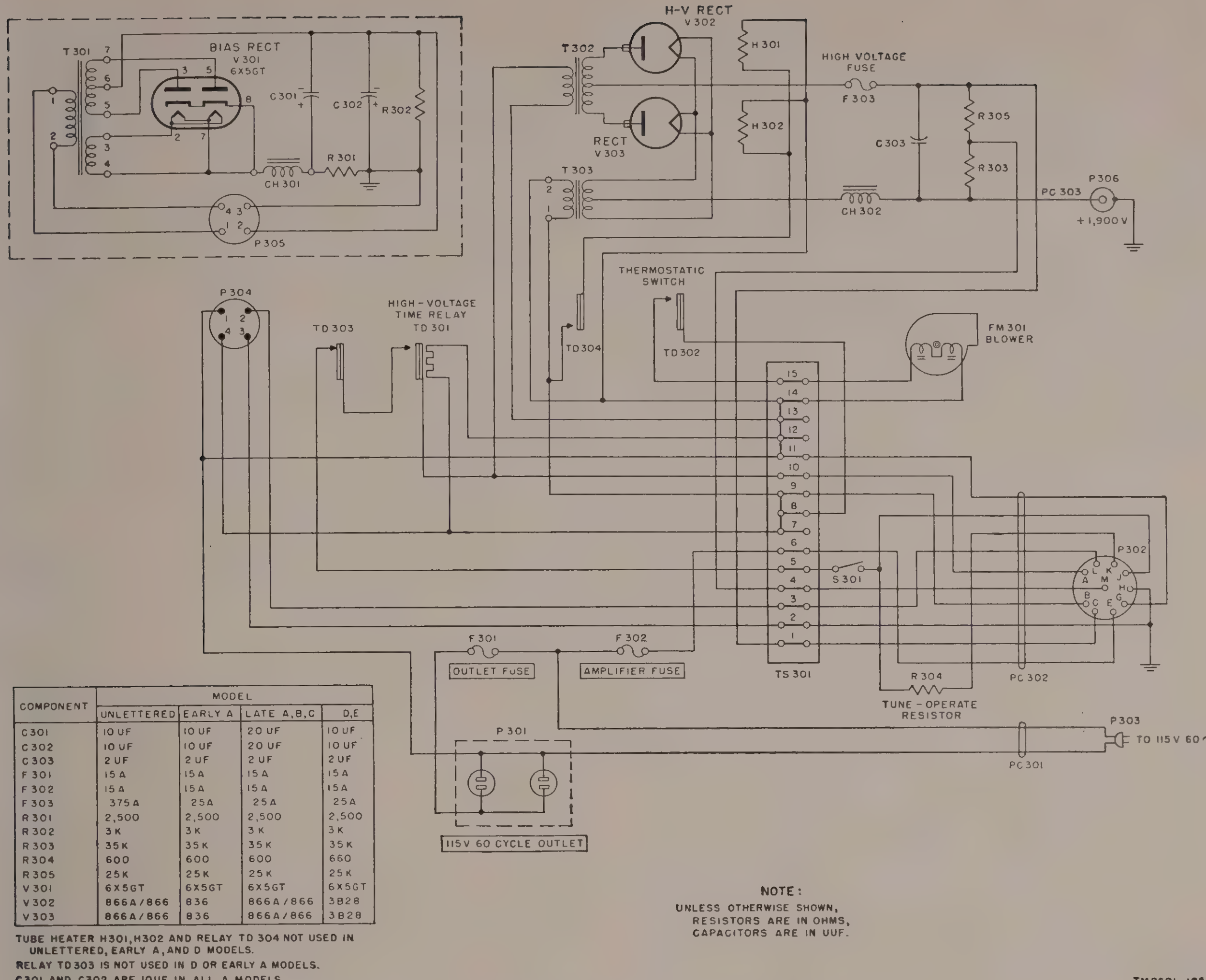
a. Power Supply PP-13(*)/TRA–1 supplies the necessary operating voltages to Amplifier AM–8(*)/TRA–1. Since all the control functions are located in the amplifier, the power supply must always be used in conjunction with this unit.

b. The input required for the power supply is approximately 800 watts at 115 volts, 50 to 60 cycles ac. It supplies output voltages to the amplifier as follows:

(1) 175 watts of 115-volt ac is supplied for the filament transformer, blower motor, and pilot lamps. The a-c output is supplied through cord PC302 and pins E and G of P302.

(2) 100 volts dc is supplied for control grid bias. This voltage is furnished by a separate bias power supply consisting of power transformer T301, full-wave rectifier tube V301 (a type 6X5GT), filter choke CH301, filter capacitors C301 and C302, and filter resistor R301. Bleeder resistor R302 maintains constant voltage under varying grid current conditions. The output is through cord PC302 and pins H (ground) and L of P302.

(3) 1,900-volt dc at 250 ma is supplied for the amplifier plates. This voltage is furnished by a high-voltage power sup-



COMPONENT	MODEL			
	UNLETTERED	EARLY A	LATE A,B,C	D,E
C301	10 UF	10 UF	20 UF	10 UF
C302	10 UF	10 UF	20 UF	10 UF
C303	2 UF	2 UF	2 UF	2 UF
F301	15 A	15 A	15 A	15 A
F302	15 A	15 A	15 A	15 A
F303	375 A	25 A	25 A	25 A
R301	2,500	2,500	2,500	2,500
R302	3 K	3 K	3 K	3 K
R303	35 K	35 K	35 K	35 K
R304	600	600	600	660
R305	25 K	25 K	25 K	25 K
V301	6X5GT	6X5GT	6X5GT	6X5GT
V302	866A/866	836	866A/866	3B28
V303	866A/866	836	866A/866	3B28

TUBE HEATER H301, H302 AND RELAY TD 304 NOT USED IN UNLETTERED, EARLY A, AND D MODELS.
RELAY TD303 IS NOT USED IN D OR EARLY A MODELS.
C301 AND C302 ARE 10UF IN ALL A MODELS

Figure 150. Power Supply PP–13(*)/TRA–1, schematic diagram.

ply consisting of h-v power transformer T302, rectifier tubes V302 and V303 in a full-wave circuit, filter choke CH302, and filter capacitor C303. The rectifier filaments are energized by filament transformer T303. H-v power is fed through cord PC303 and plug P306 to the amplifier.

c. 450-volt dc at 40 ma is supplied for the amplifier screens. This power is taken from the 1,900-volt supply through voltage-dropping resistor R303. Resistor R305 is a bleeder resistor to stabilize the output voltage of the power supply under no-load conditions. Screen voltage is fed through cord PC302 and center contact M of plug P302.

d. When TUNE OPERATE switch S204 on the amplifier is in the TUNE position, resistor R304 is inserted in series with the 115-volt input to power transformer T302. The plate and screen voltage outputs are dropped to approximately one-half their normal values.

e. Power input to the power supply is provided by a-c power cord PC301, permanently attached to the unit. Both the power supply and the amplifier are fused by screw-type fuse F302 (AMPLIFIER FUSE) on the front panel of the power supply. The two convenience outlets on the front panel are for general utility use when 115-volt ac is required. They are fused by OUTLET FUSE F301. Blower motor FM301 is energized when the filament circuits are closed by the filament ON-OFF switch in the amplifier, provided the chassis temperature in the power supply is above 85°F. and thermostatic switch TD302 has closed. If the chassis temperature

goes below approximately 75°F., the thermostatic switch will operate to open the blower circuit and stop the motor.

f. The unlettered model uses 866A/866 tubes (without tube heaters H301 and H302 and thermostatic relay TD304) as the h-v rectifiers. The early A model uses high-vacuum rectifier type 836 tubes in place of the 866A/866's. The late A, and B, and the C models use tube heaters H301 and H302 and relay TD304 for proper operation of the type 866A/866 tubes during cold weather. The D model uses gas-filled rectifiers of the 3B28 type. These tubes (3B28's) will operate at low ambient temperatures without external heating. High voltage is not applied to the V302 and V303 plates until after time delay relay TD301 has closed (approximately 30 seconds). This protects the tubes by giving the filaments time to warm up.

g. Relay TD303 is used with all sets having mercury-vapor rectifiers (866A/866) except the unlettered model. Its purpose is to keep h-v from being applied to the rectifier tubes when the air temperature in the cabinet is too cold for safe operation.

h. Switch S301 is the safety interlock which opens the h-v transformer primary winding when the power supply front door is opened.

Section IV. THEORY OF OTHER COMPONENTS

220. Antenna AS–20(*)/TRC–1

a. GENERAL. Antenna AS–20(*)/TRC–1 (fig. 56) is a three-element beam antenna connected to Radio Receiver R–19(*)/TRC–1, Radio Transmitter T–14(*)/TRC–1, or Amplifier AM–8(*)/TRA–1 by coaxial Cord CD–800 or CG–107/U. When used for transmitting, the antenna radiates the major portion of r-f energy fed to it in one direction. When used for receiving, it favors signals arriving from this same direction, reducing those from other directions. When properly adjusted, it provides a gain of 6db on transmitting or receiving, when compared to a half-wave dipole antenna at the same height. When used at both ends of a circuit, two such antennas provide an effective gain equal to multiplying the transmitter power by 16.

b. ACTION OF ANTENNA ELEMENTS. Basically, the driven or center element of Antenna AS–20(*)/TRC–1 is a simple half-wave dipole antenna fed by a coaxial line. The director and reflector elements, placed within its field, influence the direction in which power is radiated. The director, since it is shorter than the driven element at a given frequency presents capacitive reactance (current leading voltage) to the driven element, *directing* radiated power in the forward direction. The reflector, since it is longer than the driven element at a given frequency, presents inductive reactance (current lagging voltage), *reflecting* radiated power in the forward direction. Director and reflector elements are parasitically excited by the driven element, the center cross member providing only physical support and acting as a metallic insulator. See TM 11–466. Spacing between elements is an electrical quarter-wavelength at the operating frequency for which the antenna is adjusted.

c. ACTION OF COAXIAL CORD CD–800 OR CG–107/U. Cord CD–800 or CG–107/U is a shielded coaxial cable for transferring energy from the transmitter to the antenna when transmitting, and from the antenna to the receiver when receiving. Its surge impedance is 50 ohms, providing a reasonable match to the driven element of the antenna which has an average impedance of 40 ohms when all three elements are used. Cords CD–800 and CG–107/U are available in 15-, 35-, 50-, and 65-foot lengths. For further information on the operation of these and other transmission lines, refer to TM–314.

d. RADIATION PATTERNS. The various field strength patterns produced by radiation from Antenna AS–20(*)/TRC–1 are shown in figure 151. Patterns are indicated for use of the driven element alone; the driven element and a director; and the driven element, a director, and a reflector. Best results (that is, most gain) are, of course, obtained by using all three elements. In this case, the major portion of radiated power, or signal reception, is confined within an arc of 55° in the forward direction. If, because of damage or insufficient elements, it becomes necessary to erect a two-element array, note that greater gain at the standard quarter-wavelength spacing is obtained by using a reflector rather than a director. The slightly un-

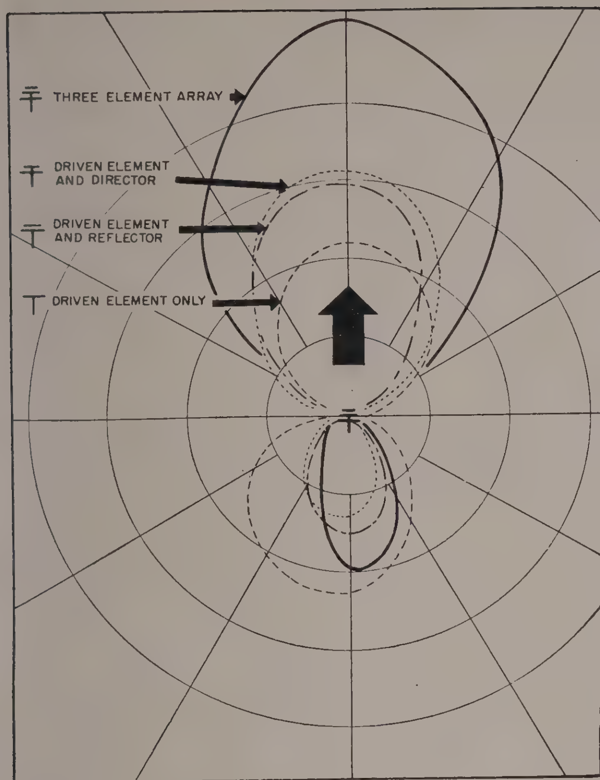


Figure 151. Radiation patterns possible with Antenna AS–20(*)/TRC–1.

symmetrical field pattern shown in figure 151 is due to unbalance caused by the construction of the dipole insulator and mast assembly.

e. POLARIZATION. With the exception of the F model, all Antennas AS–20(*)/TRC-1 can be used only for horizontal polarization. This must be taken into account if half-rhombic type antennas are to be used at the other end of the circuit. The F model of Antenna AS–20(*)/TRC–1 may be adjusted for either horizontal or vertical polarization (fig. 57). Vertical polarization is preferable when the transmitting and receiving antennas have a low effective height (less than 50 feet for the frequency band of 70 to 100 mc) and the transmission path is over salt water. Horizontal polarization is used for practically all other cases, because most *noise* signals are vertically polarized.

221. Test Oscillator TS–32(*)/TRC–1

Test Oscillator TS–32(*)/TRC–1 (figs. 16 and 39) uses three tubes, two of which are dual-purpose types. These tubes provide a crystal-controlled, f-m test signal in the range of 70 to 100 mc for alining and testing Radio Receiver R–19(*)/TRC–1. A schematic diagram of the test oscillator is shown in figure 152.

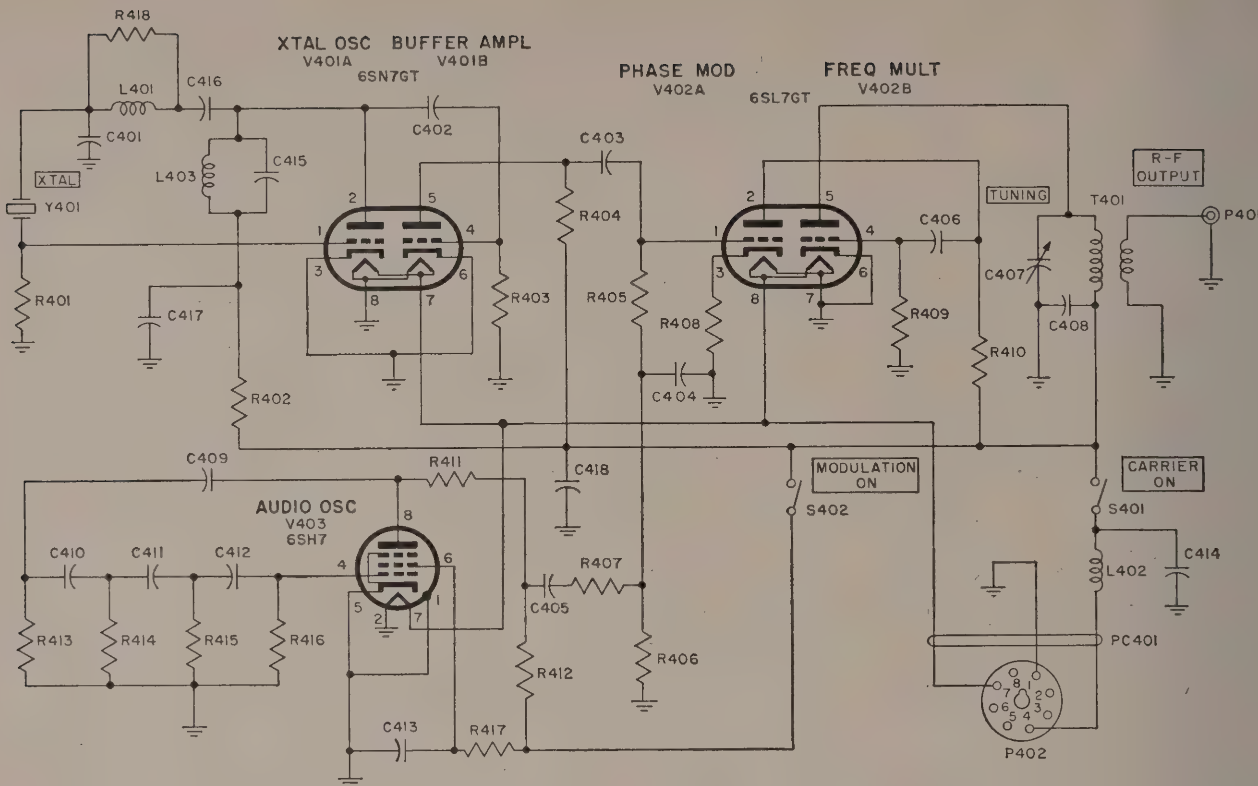
a. CRYSTAL OSCILLATOR AND BUFFER AMPLIFIER. The crystal oscillator uses one triode section of a dual-triode type 6SN7GT tube (V401A) in a fixed-tuned circuit practically identical to that used in Radio Transmitter T–14(*)/TRC–1. The regular transmitter crystals are used. In order to amplify the output of the crystal oscillator and reduce the effects of differences in activity between individual crystals, the other triode section of the type 6SN7GT tube (V401B) is used as an untuned buffer amplifier to drive phase modulator V402A.

(1) R401 is the crystal oscillator grid resistor. Capacitor C401 is part of the voltage feedback circuit. R418 (not in the unlettered through B models) and L401 act as a *band-broadening* device to insure crystal oscillation over the 729- to 1,041-kc band (to which the transmitter crystals are ground). C416 has been added in the C and D models to keep the d-c plate voltage off the crystal. L403 and C415 (in the C and D models) form a tuned circuit which compensates the frequency output *dead spot* near 85 mc. C417 (not in the unlettered through B models) and R402 decouple the plate circuit from the B+ lead. The output of the crystal oscillator is coupled to the grid of the buffer amplifier section by d-c blocking capacitor C402.

(2) In the buffer amplifier, R403 is the grid return resistor to ground. Plate supply voltage is fed through resistor R404. The r-f output of the buffer amplifier is coupled to the grid of phase modulator V402 through capacitor C403.

b. PHASE MODULATOR AND FREQUENCY MULTIPLIER. These two stages utilize tube V402.

(1) The phase modulator is similar to the modulator used in Radio Transmitter T–14(*)/TRC–1. It uses one-half of a dual-triode amplifier type 6SL7GT tube (V402A). Since it is modulated at only one frequency (approximately 1,000 cycles), no elaborate precautions



COMPONENT VALUES

COMPONENT	MODEL			
	UNLETTERED A, B	EARLY C	LATE C	D
C401	40	22	22	22
C402	100	100	100	100
C403	500	510	510	510
C404	5,000	5,100	5,000	5,000
C405	5,000	5,100	5,100	5,100
C406	100	100	100	100
C407	3-54	3-54	3-54	3-54
C408	1,500	1,500	2,000	5,000
C409	100	100	100	100
C410	100	100	100	100
C411	100	100	100	100
C412	1,500	1,500	2,000	2,000
C413	5,000	5,100	5,100	5,000
C414	5,000	5,100	2,000	5,000
C415	NOT USED	39	39	39
C416	NOT USED	5,100	5,100	5,100
C417	NOT USED	5,100	5,100	5,000
C418	NOT USED	NOT USED	NOT USED	5,000
L401	770UH	770UH	770UH	770UH
L402	NOT USED	120UH	120UH	120UH

COMPONENT	MODEL			
	UNLETTERED A, B	EARLY C	LATE C	D
L403	NOT USED	770UH	770UH	770UH
R401	350K	330K	330K	360K
R402	50K	47K	47K	51K
R403	15K	15K	15K	15K
R404	10K	10K	10K	10K
R405	50K	47K	47K	51K
R406	250K	270K	270K	270K
R407	100K	100K	100K	100K
R408	50K	15K	15K	15K
R409	100K	100K	100K	100K
R410	50K	47K	47K	51K
R411	40K	39K	39K	39K
R412	10K	10K	22K	22K
R413	500K	470K	680K	680K
R414	500K	470K	680K	680K
R415	500K	470K	680K	680K
R416	5MEG	4 7MEG	5 1MEG	5 1MEG
R417	100K	100K	68K	100K
R418	NOT USED	15K	15K	15K

R413 THROUGH R415 ARE 680K IN SOME A MODELS.
IN THE B MODEL, C414 IS CONNECTED ON THE OTHER SIDE OF S401, R408 IS 15K, R413 THROUGH R415 ARE 680K, AND L402 (120UH) IS USED.
REFERENCE SYMBOLS C415 AND C416 ARE INTERCHANGED ON ORDER NO 11850-P-49.
IN SOME C MODELS, R413 THROUGH R15 ARE 510 K.

NOTE:
UNLESS OTHERWISE SHOWN:
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

TM2601-126

Figure 152. Test Oscillator TS-32(*)/TRC-1, schematic diagram.

need be taken to provide uniform response. R406 is the grid return resistor; R405 and capacitor C404 filter rf from the V403 circuit.

(2) The frequency multiplication required to convert the crystal oscillator and phase modulator output to the operating frequency range of 70 to 100 mc

is provided in frequency multiplier V402B. The f-m signal (on one ninety-sixth of the output frequency) from the modulator is coupled to the grid of the frequency multiplier section by capacitor C406. The frequency multiplier operates as a Class C stage with grid leak bias; a tuned circuit, consisting of the primary of T401 and C407, is connected in the plate circuit of this stage and is tuned to the desired output frequency between 70 and 100 mc. Because of the large multiplication (96 times) required in this stage, the output voltage is small but is sufficient for tuning the receiver. This output is inductively coupled by T401 to coaxial transmission line connector P401 (marked R-F OUTPUT).

c. AUDIO OSCILLATOR. A type 6SH7 tube (V403) is used as an audio oscillator to generate a 1,000-cycle tone. This tone may be used to frequency-modulate the test signal. The oscillator uses a phase-shift circuit of the resistance-capacitance type. Capacitors C409, C410, and C411 and resistors R413, R414, and R415 are the frequency-determining elements. Capacitor C412 and resistor R146 are the grid capacitor and grid leak, respectively. A portion of the audio voltage appearing in the plate circuit is taken off plate load resistors R411 and R412 by coupling capacitor C405. This voltage is fed through isolation resistor R407 to the modulator circuit. The audio oscillator is turned on or off by MODULATION ON switch S402 which is in series with its plate and screen supply. R417 is the screen voltage-dropping resistor, and C413 keeps the screen at a-f ground potential.

d. POWER AND CONTROL CIRCUITS. Filament and plate power for Test Oscillator TS–32(*)/TRC–1 is taken from Radio Receiver R–19(*)/TRC–1. An extra tube socket (P106) is provided on the receiver chassis for this purpose, and the test oscillator is provided with multi-connection cord PC401 and plug P402 which is inserted into socket P106 when the oscillator is used. Plate and screen currents are brought in through pins 1 (ground) and 4 of socket P106 and plug P402. The heaters of the vacuum tubes in Test Oscillator TS–32(*)/TRC–1 are energized (through pins 1 and 7 of P402) when the power cable is connected to the receiver. Two switches are provided on the chassis of the test oscillator to provide on-off control of the test carrier and modulation. Switch S401, marked CARRIER ON, controls the plate and screen supply to V401 and V402. Switch S402, marked MODULATION ON, controls the plate and screen supply to the audio oscillator. It is possible to get an unmodulated r-f signal by throwing S402 to the off position. The B+ circuit is isolated from the receiver by L402 (in the C and D models) and C414. The D model has capacitor C418 on the B+ line for additional r-f bypassing.

222. Control Box C–21(*)/TRC–1

Radio receivers at relay stations are corded to transmitters relaying in the same direction.

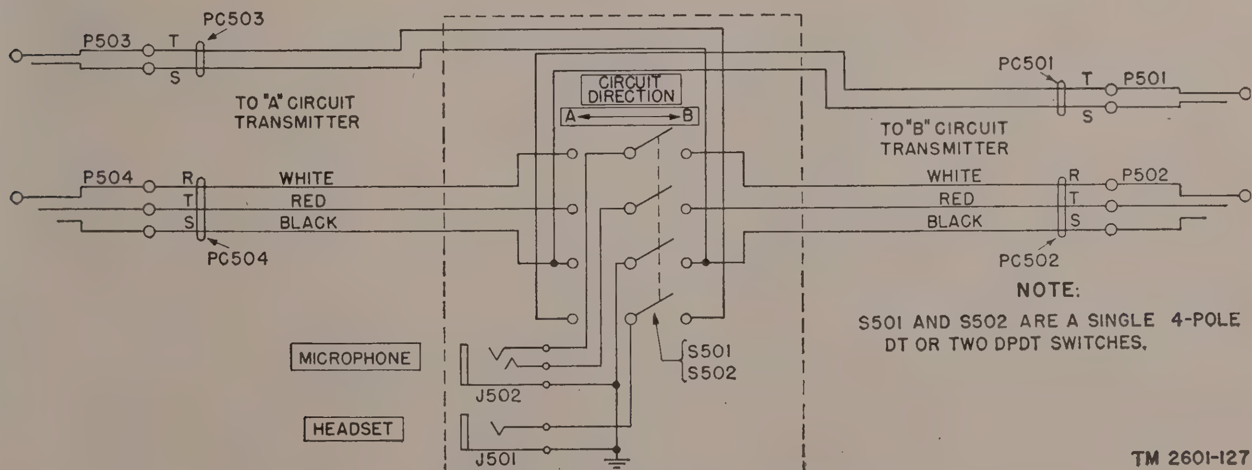


Figure 153. Control Box C–21(*)/TRC–1, schematic diagram.

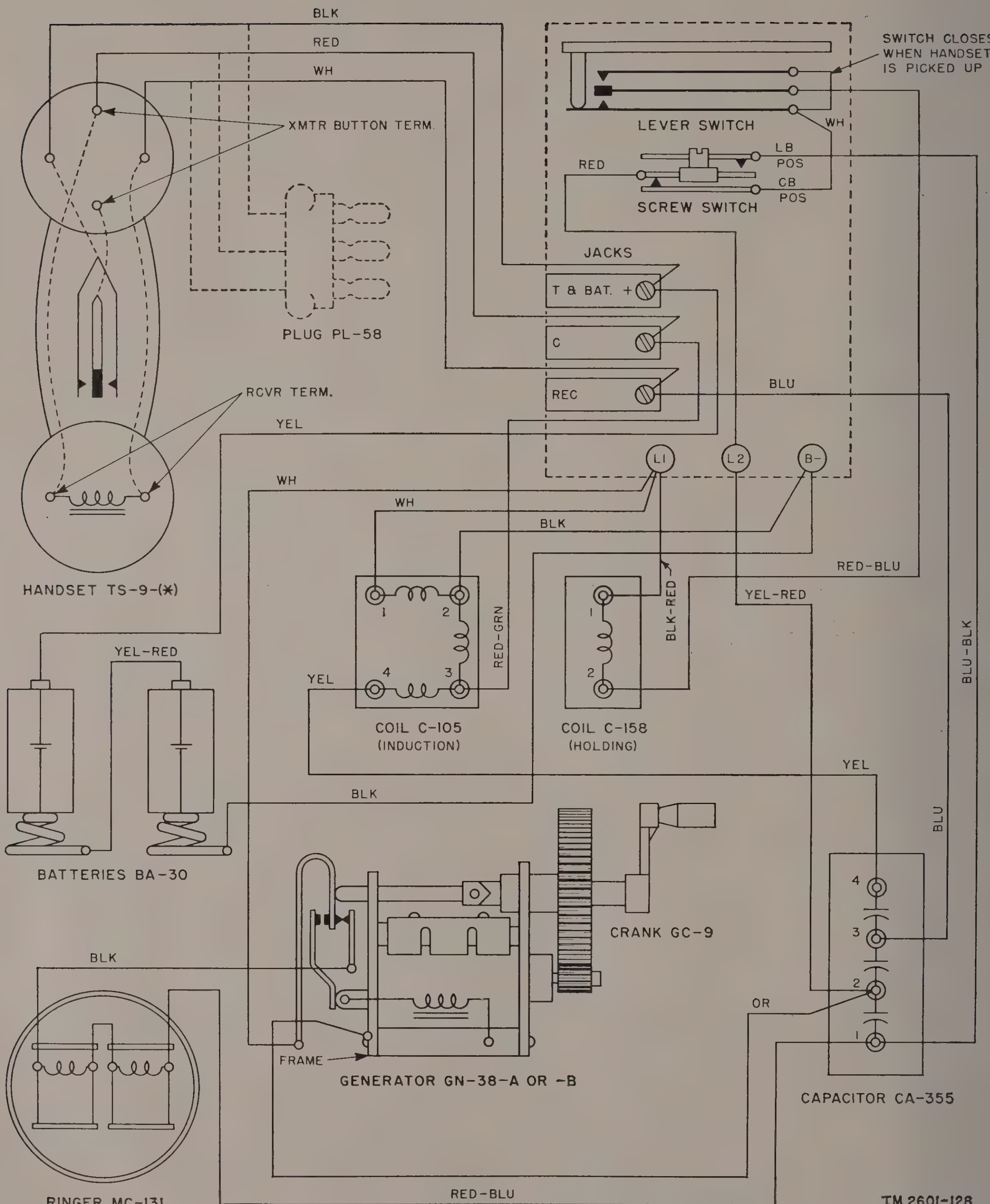


Figure 154. Telephone EE–8–B, wiring diagram.

If the handset were plugged into the HEADSET and MICROPHONE jacks of either transmitter at a relay station, the earphone would reproduce the communications coming from one terminal while the microphone would permit transmitting only toward the other terminal. Control Box C–21(*)/TRC–1 (figs. 18 and 85) is designed to cross the connections from each relay station receiver internally and thus permit listening from and talking to the same terminal by setting the panel switch in either the A or B direction as desired (fig. 153). Unlettered, A, B, C, and D models of Control Box C–21(*)/TRC–1 have been built. The major differences are the use of two ganged DPDT (double-pole, double-throw) switches in some models, while other models use a single four-pole, double-throw switch. The latest procurements incorporate waterproof jacks and jack covers.

223. Minor Components

The following minor components are used with these equipments.

a. TELEPHONE EE–8. This unit (fig. 27) is used for talking between the carrier terminal and the radio terminal over the simplex circuit on the spiral-four cable. A wiring diagram of the B model is shown in figure 154. Telephone EE–8–(*) is covered in paragraph 31*d*.

b. HANDSET H–23/U. Handset H–23/U (fig. 25) is a standard handset with a butterfly type press-to-talk switch located on the handle for controlling microphone and transmitter keying circuits (par. 31*a*). The single-button carbon microphone has an impedance of approximately 50 ohms and the earphone has an impedance of approximately 250 ohms. A rubber-covered cord terminates in two plugs: Plug PL–55 for earphone connections, and Plug PL–68 for the microphone and push-to-talk switch connections (fig. 155). In actual operation, the earphone is connected across the secondary winding of receiver output transformer T113. The microphone connects to the 50-ohm primary of transformer T10 in the transmitter. The resulting impedance match permits high microphone efficiency.

c. JUNCTION BOX J–85/G. Junction Box J–85/G (figs. 20 and 156) permits either of two power sources to be connected to a single load. This allows two sources of power, such as two Power Units PE–75–(*), to be connected permanently to the junction box and permits either one to be connected to the load by throwing the toggle switch to either the "A" or the "B" position. The two 10-foot cords, terminating in plugs P401 and P402, are each plugged into a Power Unit PE–75–(*). The load or extension Cord CD–711 is plugged into either receptacle J401 or J402. J401 and J402 are paralleled. Depending on the direction of three-pole, double-throw switch S401, either the A or B source cord is connected to the output receptacles. This arrangement is necessary since Power Units PE–75–(*) can be operated only 24 hours at a time due to maintenance requirements. Junction Box J–85/G permits continuous operation of radio stations without power interruptions due to refueling or maintenance.

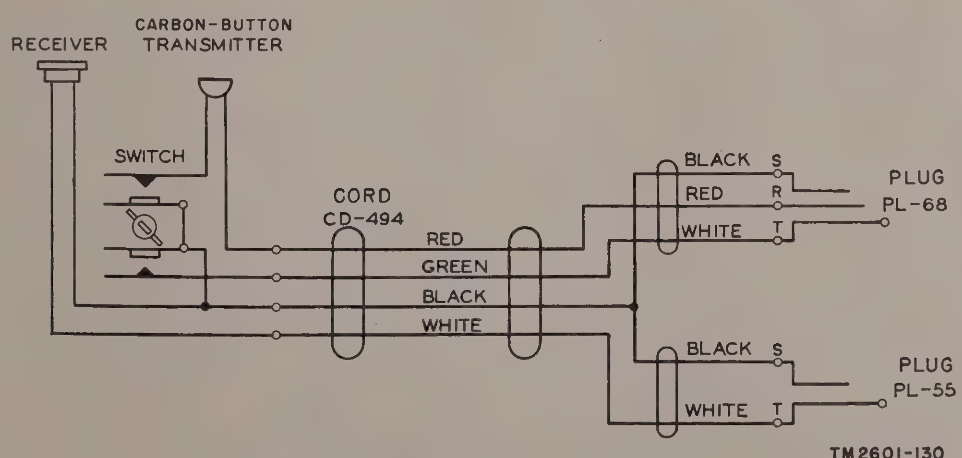


Figure 155. Handset H–23/U, schematic diagram.

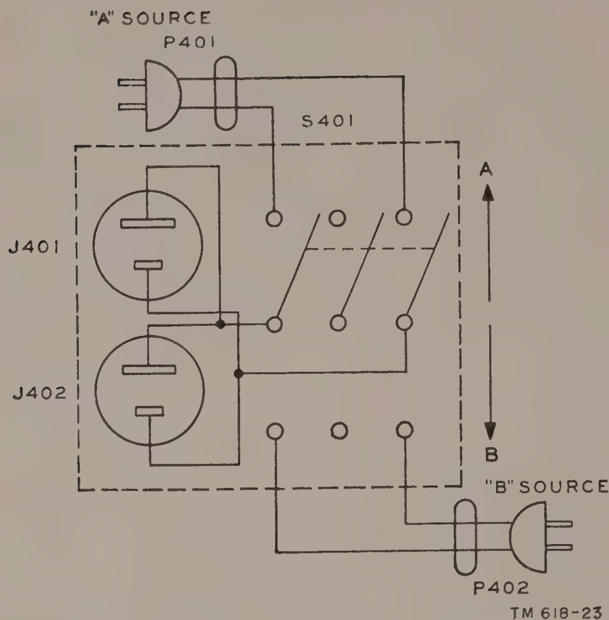


Figure 156. Junction Box J–85/G, schematic diagram.

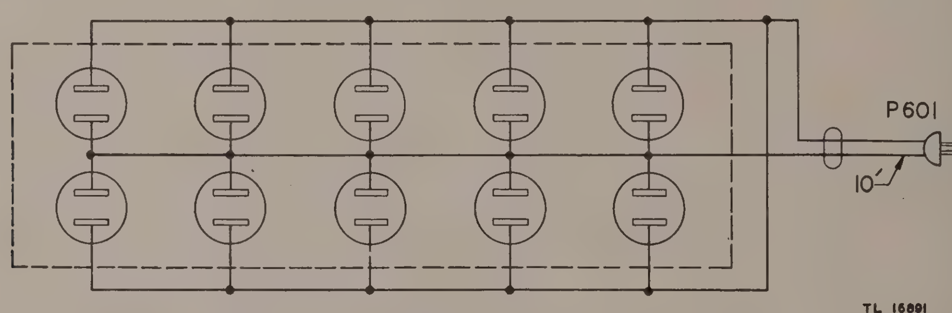


Figure 157. Junction Box JB–110, schematic diagram.

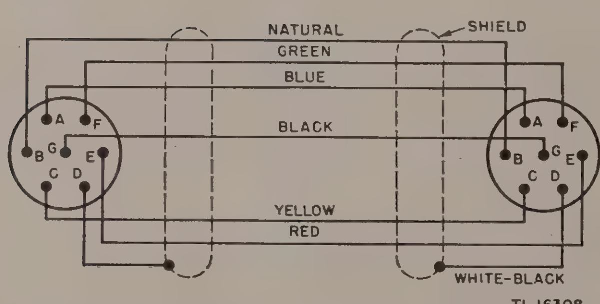


Figure 158. Cord CX–104/TRC–1, schematic diagram.

d. Junction Box JB–110. Junction Box JB–110 contains 10 outlet receptacles wired in parallel and connected to a 10-foot rubber-covered cord terminating in a standard male plug (figs. 19 and 157). The junction box is used at radio stations as a multiple outlet box to permit up to 10 devices to be plugged into an a-c line at the same time. Plug P601 is connected to the receptacle of Cord CD–711, to one of the receptacles of Junction Box J–85/G or to the power source. The 10 receptacles accommodate the plugs of the transmitters, receivers, shelter lights, trouble lamps, soldering irons, etc.

e. Cord CX–104/TRC–1. Cord CX–104/TRC–1 is described in paragraph 30*b*. Its schematic diagram is shown in figure 158.

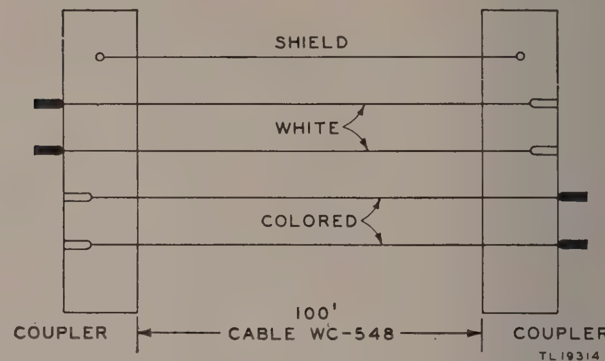


Figure 159. Cable Assembly CC–368–S, schematic diagram.

f. Cable Assembly CC–368–S and Cable Stub CC–356–S. The cable assembly and cable stub used to connect the spiral-four cable to the transmitter at a radio terminal station are described in paragraph 31*k* and *l*. Their schematic diagrams are shown in figures 159 and 160.

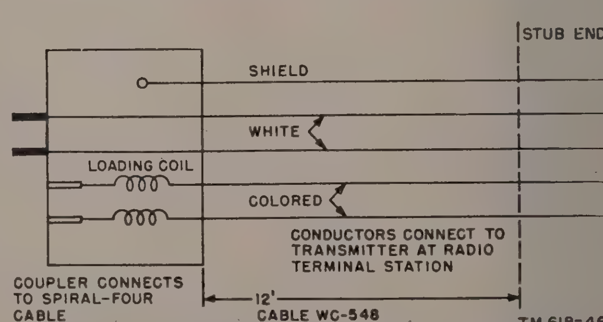


Figure 160. Cable Stub CC–356–S, schematic diagram.

CHAPTER 7
FIELD MAINTENANCE INSTRUCTIONS

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing Amplifier Equipment AN/TRA-1(*), be extremely careful because of the high voltages exposed. Always disconnect the a-c input cord, PC301, and discharge capacitor C303 before doing any testing. Keep one hand in a pocket when measuring socket voltages with the probe. Before touching any part after the voltage is shut off, short the part to ground.

224. Trouble-Shooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, r-f arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be localized by *checking voltage and resistance*. Teletypewriter circuits are usually checked by measuring the current.

a. SYSTEM SECTIONALIZATION. System sectionalization is discussed in paragraph 170.

b. COMPONENT SECTIONALIZATION AND LOCALIZATION. The tests listed below aid in isolating the source of trouble. To be effective, the procedure should be followed in the order given. Remember that servicing procedure should cause no further damage to a unit. First, trouble should be localized to a single stage or circuit. Then the trouble may be isolated within that stage or circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is summarized as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 169) is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the unit which might occur through improper servicing methods and in forestalling future failures.

(2) *Input resistance measurements.* These measurements (par. 233) prevent further damage to the receiver from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.

(3) *Operational tests.* The operational tests (par. 234) are important because they frequently indicate the general location of trouble. In many instances, the information gained will determine the exact nature of the fault. In order to utilize this information fully, all symptoms must be interpreted in relation to one another.

(4) *Trouble-shooting charts.* The trouble symptoms listed in these charts (pars. 236 through 240) will aid greatly in localizing trouble.

(5) *Signal substitution.* The principal advantage of the signal substitution method (par. 242) is that it usually enables the repairman to localize a trouble accurately and quickly to a given stage when the general location of the trouble is not immediately evident from other tests.

(6) *Intermittents.* In all of these tests, the possibility of intermittents should not be overlooked. If present, this type often may be made to appear by tapping or jarring each unit of the set. It is possible that the trouble is not in the receiver itself but in the installation (antenna system, power supply, or vehicle if mounted therein), or the trouble may be due to external conditions. In this event, test the installation if possible.

225. Trouble-Shooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following trouble-shooting data:

a. RECEIVER R–19(*)/TRC–1.

Figure or paragraph No.	Description
Figure 180	Radio Receiver R–19/TRC–1, schematic diagram.
Figure 181	Radio Receivers R–19A/TRC–1 through R–19C/TRC–1, schematic diagram.
Figure 182	Radio Receivers R–19D/TRC–1 and R–19E/TRC–1, schematic diagram.
Figure 183	Radio Receiver R–19H/TRC–1, schematic diagram.
Figure 161	Voltage and resistance diagram of early receivers.
Figure 162	Radio Receiver R–19H/TRC–1, voltage and resistance diagram.
Figure 169	Radio Receiver R–19H/TRC–1 chassis, top view.
Figure 173	Radio Receiver R–19H/TRC–1 chassis, bottom view.
Figure 177	Radio Receiver R–19H/TRC–1, main component mounting board.
Paragraph 241*b*	D-c resistance of transformers and coils.

b. TRANSMITTER T–14(*)/TRC–1.

Figure or paragraph No.	Description
Figure 184	Radio Transmitter T–14/TRC–1, schematic diagram.
Figure 185	Radio Transmitters T–14A/TRC–1, through T–14C/TRC–1, schematic diagram.
Figure 186	Radio Transmitters T–14D/TRC–1 and T–14E/TRC–1, schematic diagram.
Figure 187	Radio Transmitter T–14H/TRC–1, schematic diagram.
Figure 163	Voltage and resistance diagram of early transmitters.
Figure 164	Radio Transmitter T–14H/TRC–1, voltage and resistance diagram.
Figure 170	Radio Transmitter T–14H/TRC–1, top view.
Figure 174	Radio Transmitter T–14H/TRC–1 chassis, bottom view.
Paragraph 241*a*	D-c resistances of transformers and coils.

c. AMPLIFIER AM–8(*)/TRA–1.

Figure or paragraph No.	Description
Figure 149	Amplifier AM–8(*)/TRA–1, schematic diagram.
Figure 165	Amplifier AM–8/TRA–1, wiring diagram showing voltages and resistances.
Figure 166	Amplifier AM–8B/TRA–1, wiring diagram showing voltages and resistances.
Figure 171	Amplifier AM–8A/TRA–1 chassis, top view.
Figure 175	Amplifier AM–8(*)/TRA–1 chassis, bottom view.
Paragraph 241*c*	D-c resistances of transformers and coils.

d. POWER SUPPLY PP–13(*)/TRA–1.

Figure or paragraph No.	Description
Figure 150	Power Supply PP–13(*)/TRA–1, schematic diagram.
Figure 167	Wiring diagram of early power supplies showing voltages and resistances.
Figure 172	Late model of Power Supply PP–13D/TRA–1 chassis, top view.
Paragraph 241*d*	D-c resistances of transformers and coils.

e. TEST OSCILLATOR TS–32(*)/TRC–1.

Figure No.	Description
152	Test Oscillator TS–32(*)/TRC–1, schematic diagram.
168	Test Oscillator TS–32D/TRC–1, voltages and resistances.
176	Test Oscillator TS–32C/TRC–1 chassis, bottom view.

226. Test Equipment Required for Trouble Shooting

The test equipment required for trouble shooting is listed below. The technical manuals and the stock numbers associated with the test equipment are also listed.

Test equipment	Technical manual	Signal Corps stock No.
Audio Oscillator TS–382A/U, or equal.	TO 16–35TS382–2	3F4325–382
Bird Corporation Model 67 rf wattmeter, or equal.	Instruction book.	-------------
Electronic Multimeter TS–505/U, or equal.	TM 11–5511	3F4325–505
Multimeter TS–352/U, or equal.	TM 11–5527	3F4325–352
Oscilloscope BC–1060–A, or equal.	TM 11–2526	3F3630–1060
Output Meter TS–585/U, or equal.	TM 11–5017	3F3323
RF Wattmeter ME–11/U, or equal.	NAVSHIPS 91,118.	-------------
Signal Generator TS–497A/URR, or equal.	TM 11–5030	3F4325–497
Signal Generator AN/URM–27, or equal.	TM 11–5522	3F3901.2–27
Tube Tester I–177, or equal.	TM 11–2627	3F5720–177

227. General Precautions

Whenever any service is performed, observe the following precautions very carefully:

a. Be careful when covers are removed or trap doors opened; dangerous voltages are exposed.

b. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer or filter, has a number of connections, tag each lead to it.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to locate.

(5) When a part is replaced in r-f or i-f circuits, it must be placed exactly as was the original one. A part which has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or possibly in oscillation of the circuit.

228. Voltage Measurements

a. Precautions Against High Voltage. High voltages are dangerous and can be fatal. Certain precautions *must* be followed when measuring voltages above a few hundred volts. When it is necessary to measure high voltages, observe the following rules:

(1) Connect the ground lead to the voltmeter.

(2) On h-v checks, also ground the case or panel of test instruments if made of metal.

(3) Place one hand in your pocket.

(4) If the voltage is less than 300 volts, checks may be made with power on by touching the probe of the test lead to the hot terminal.

(5) If the voltage is greater than 300 volts, shut off the power, connect the hot test lead, step away from the voltmeter, turn on the power, and note the readings on the voltmeter. DO NOT TOUCH ANY PART OF THE VOLTMETER.

b. Voltmeter Loading. It is essential that the voltmeter resistance be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is comparable to the circuit resistance, the voltmeter will indicate a lower voltage than the actual voltage present when the voltmeter is removed from the circuit.

(1) The resistance of the voltmeter can always be calculated by the following simple rule: The resistance of the voltmeter equals the ohms per volt multiplied by the full-scale range in volts.

(2) To minimize voltmeter loading in high-resistance circuits, use the highest voltmeter range. The decreased loading of the voltmeter more than compensates for the inaccuracy which results from reading only a small deflection on the scale of the voltmeter.

229. Resistance Measurements

a. GENERAL. When a fault develops in a circuit, its effect very often shows up as a change in the resistance values. To assist in the localization of such faults, trouble-shooting data include the normal resistance values as measured at the tube socket and at test jacks or terminal boards. These values are measured between the indicated points and ground, unless otherwise stated.

(1) *Precautions.*

(*a*) Before making any resistance measurements, disconnect the power source. An ohmmeter is essentially a low-range voltmeter and battery. If the ohmmeter is connected in a circuit which already has voltages in it, the needle will be knocked off-scale and the voltmeter may be burned out.

(*b*) Capacitors must always be discharged before resistance measurements are made.

(2) *Correct use of high and low ranges.* It is important to know when to use the low-resistance and high-resistance ranges of an ohmmeter when checking any circuit. When checking circuit continuity, the ohmmeter should be set on its lowest range. If a medium or high range is used, the pointer may indicate zero ohms, even if the resistance is as high as 500 ohms. When checking high resistances or measuring the leakage resistance of capacitors or cables, the highest range should be used. If a low range is used, the pointer will indicate infinite ohms, even though the actual resistance is less than a megohm.

(3) *Parallel resistance connections.* In a parallel circuit, the total resistance is less than the smallest resistance in the circuit. This is important to remember when trouble shooting with the aid of a schematic diagram.

(*a*) When a resistance is measured and the value found to be lower than expected, make a careful study of the schematic to be certain that there are no resistances in parallel with the one that has been measured. Before replacing a resistor, disconnect one terminal from the circuit and check the resistance again to make sure that the low reading was not due to another parallel connection.

(*b*) Sometimes it will be found that there is a coil or transformer winding in parallel with the resistor. In this case, the resistor must be checked by removing one terminal from the circuit and then measuring its resistance.

(4) *Tolerance values of resistance measurements.* The tolerance of a resistor refers to the difference between the rated value and the actual value of the resistor.

(*a*) Most resistors used in radio circuits have a tolerance of 10 percent. For instance, the rated value of a grid resistor is said to be 1 megohm. If the actual measurement varies between .9 and 1.1 megohms, it will be considered as normal. With precision resistors and potentiometers, the tolerance allowed will appear on the part.

(*b*) The tolerance value for transformer windings is usually between 1 and 5 percent. Any transformer winding showing more than that allowable deviation in resistance should be checked very closely.

b. HIGH-RESISTANCE MEASUREMENTS. Many leakages will not show up when measured at low voltages. It may be necessary at some time to check the resistance of components to a common ground, such as when determining whether or not transformer windings are shorting to the transformer case or core, or when determining whether or not the conductor within a length of coaxial cable is shorting to the outer shield. A voltage supply of approximately 300 volts can be connected in series with the 300-volt range of a voltmeter and both elements of the component suspected to be faulty. A leakage path will be indicated by a voltage reading.

230. Capacitor Tests

Capacitors which are leaky or shorted can be found by resistance measurement checks of the stage. A capacitor suspected of being open can best be checked by shunting a good capacitor

of approximately the same value across it. It should be remembered that a leakage value of 50 to 100 microamperes per μf (microfarad) is normal for electrolytic capacitors. When using an ohmmeter to check electrolytics, the polarity of the capacitor must be observed.

231. Current Measurements

Current measurements other than those indicated by the panel meters are not ordinarily required in trouble shooting the radio set. Under special circumstances, where the voltage and resistance measurements by themselves are not sufficient to localize the trouble, a current measurement can be made by opening the circuit and connecting an ammeter to measure the current. This procedure is not recommended except in very difficult cases. However, teletypewriter circuits are usually checked by current measurements.

a. When the meter is inserted in a circuit to measure current, it always should be inserted away from the r-f end of the resistor. For example, when measuring plate current, do not connect the meter next to the plate of a tube, but insert it next to the end of the resistor which connects to the power source.

Caution: When measuring current, always set the meter at its highest range. Then, if necessary, decrease the range of the meter to obtain an accurate reading.

b. In most cases, the current flows through a resistance which is either known or can be measured with an ohmmeter. The current flowing in the circuit can be determined by dividing the voltage drop across the resistor by its resistance value. This method is better than that above, because it does not subject the relatively delicate ammeter to damaging voltages.

232. Tubes

a. FAILURES. Tube failures are responsible for a large percentage of the faults which occur in radio sets. Do not attempt to find the source of trouble in these sets by indiscriminately changing tubes. Do not resort to tube changing until the trouble has been traced to a particular unit.

b. CHECKING. Tube checkers are used to check either the emission or the mutual conductance of the tubes and to test for shorted elements. They will not test the performance of h-v tubes or rectifiers; however, they are useful for checking receiving-type tubes used in the receivers and in the converter, control, and exciter units. Remember that the results obtained from the tube checker are not the same as those under which the tube operates in the set. For this reason, the final test of a tube must be its replacement with a tube that is known to be good.

233. Checking Filament and B+ Circuits for Shorts

Trouble within one of the units may often be detected by checking the resistance of the filament and h-v circuits before applying power to the equipment, thereby preventing further damage to the power supply. Make the following checks before attempting to place the unit in operation. Remove the power cords from their receptacles before checking.

a. RADIO RECEIVER R–19(*)/TRC–1. The resistance between pin 8 of V116 and ground should be about 20,000 ohms. Check the schematic of the receiver being worked on if the voltage or resistance readings do not match those of figure 161 or figure 162.

(1) The ohmeter pointer should first move toward the zero resistance point, then slowly swing back to 20,000 ohms. This is a normal indication due to the charging of the filter capacitors. If the meter reads about 20,000 ohms, the resistance of the B+ circuit is all right.

(2) If the reading is zero or some low value of resistance, remove the tubes one at a time, watching the ohmmeter. If the reading goes from zero resistance to 20,000 ohms after pulling the tube, a short within that tube is indicated. Replace the tube with a good one and check again. Be careful not to leave the ohmmeter connected for long periods of time, because the battery will be weakened.

(3) If removal of the tube does not change the reading to 20,000 ohms, the short is in the circuit. Check filter capacitors C162, C163 (not in the H model), and C164 by measuring the resistance across each. Disconnect the capacitor first. If the resistance across any of the

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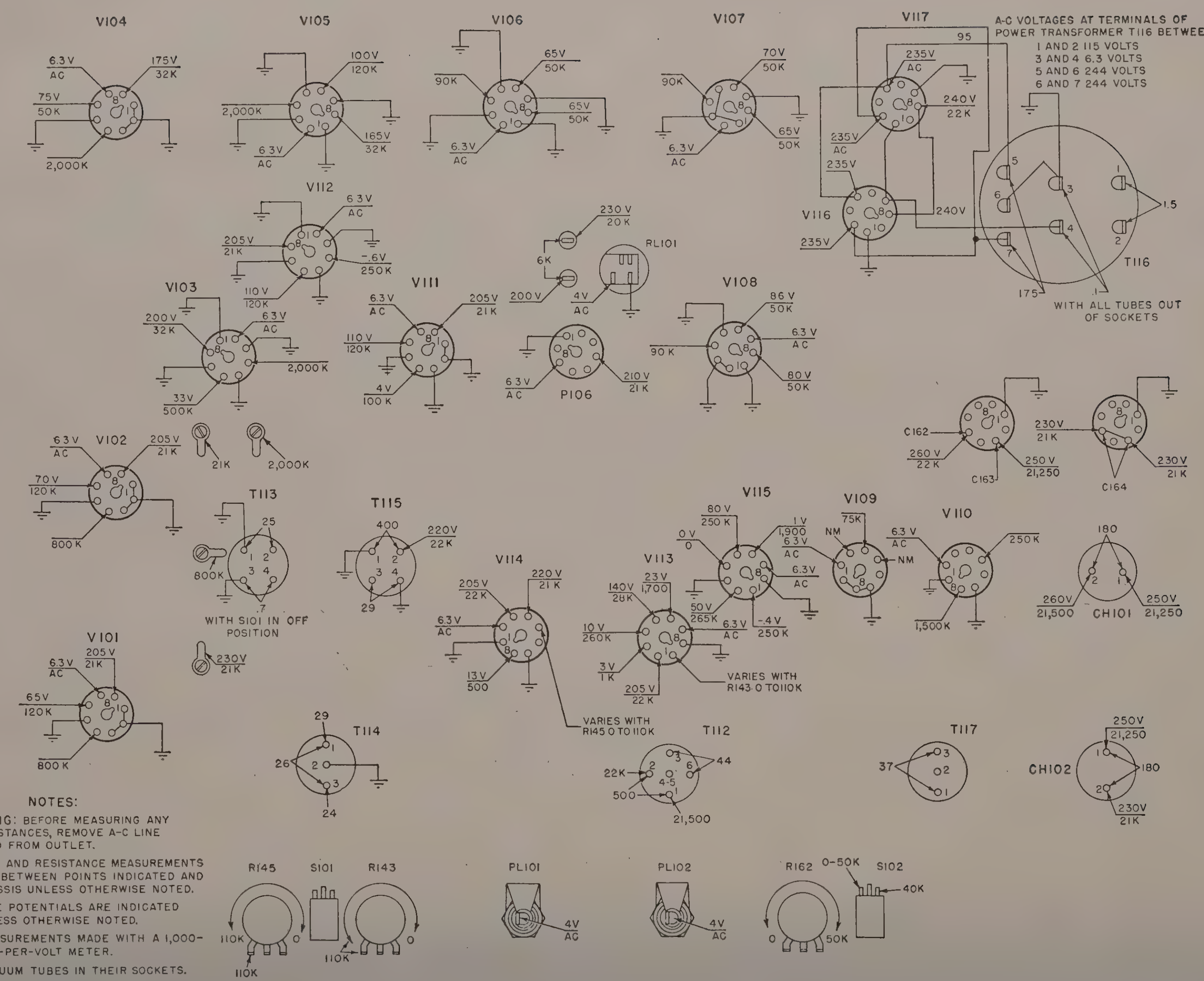


NOTES:

1. WARNING: BEFORE MEASURING ANY RESISTANCES, REMOVE A-C LINE CORD FROM OUTLET.
2. VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN POINTS INDICATED AND CHASSIS UNLESS OTHERWISE NOTED.
3. POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.
4. ALL MEASUREMENTS MADE WITH A 1,000-OHM-PER-VOLT METER.
5. ALL VACUUM TUBES IN THEIR SOCKETS.
6. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.

Figure 161. Voltage and resistance diagram of early receivers.

capacitors is less than 20,000 ohms (try reversing the ohmmeter leads), the capacitor is bad and must be replaced.

(4) If the capacitors are not shorted, check the h-v wiring, switch S102, the r-f bypass capacitors, potentiometer R162, and relay RL101.

(5) If the resistance between pin 8 and ground of V116 is some value between power supply is suspected, inspect the filament leads from the tube sockets for shorts. If none is evident, remove the tubes and pilot lamp, unsolder the lead from terminal 4 of transformer T116 and measure the resistance between pin 2 of tube V116 and ground. If the reading is zero, one of the filament leads is grounded.

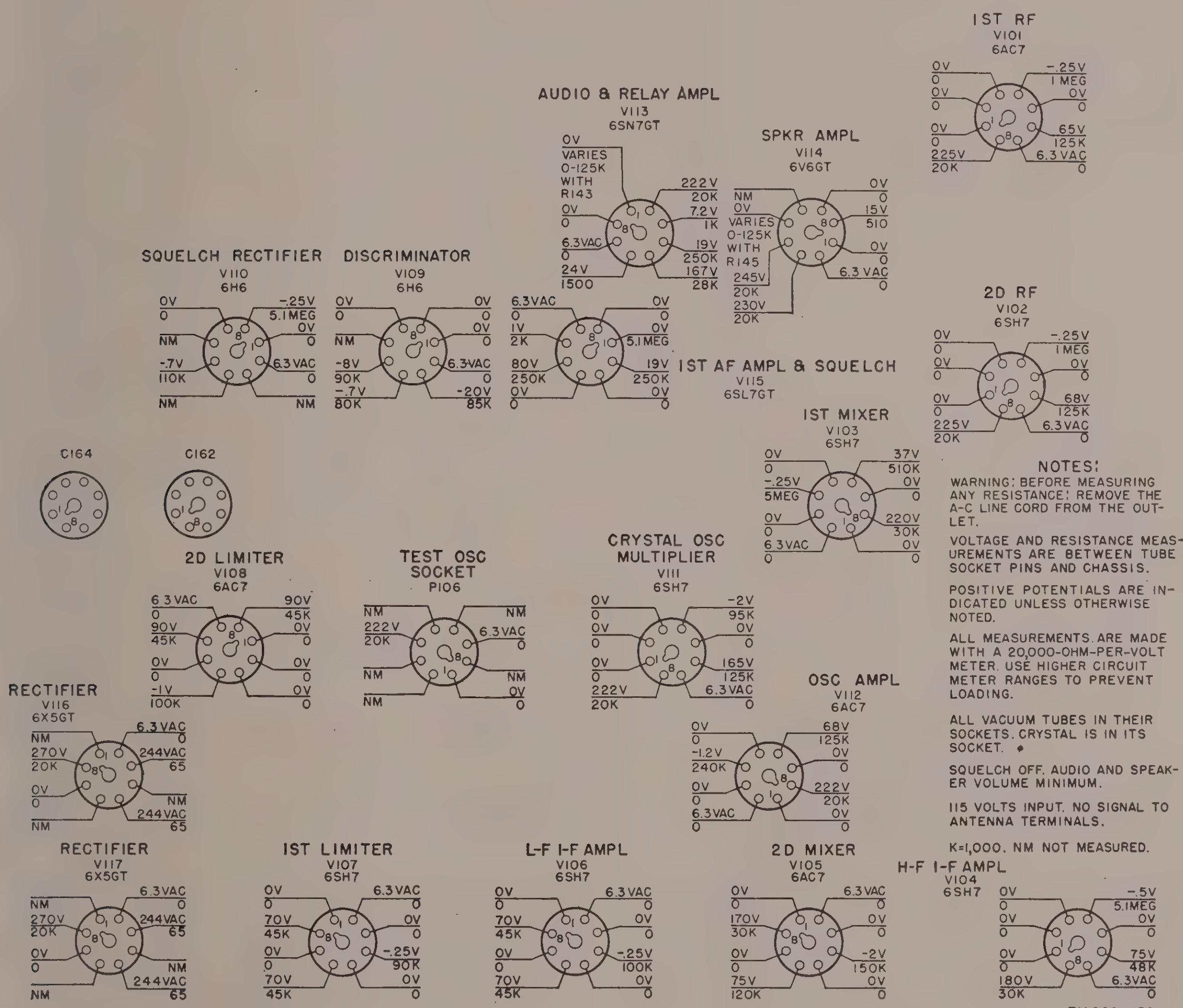


Figure 162. Radio Receiver R–19H/TRC–1, voltage and resistance diagram.

0 and 20,000 ohms, check the B+ circuit for shorts, using the meter reading as a guide to the possible location of the short.

(6) If a short in the filament circuit of the

b. Radio Transmitter T–14(*)/TRC–1. With the transmitter disconnected from the 110-volt a-c power, measure the resistance between the cathode lead of either V10 or V11 and ground.

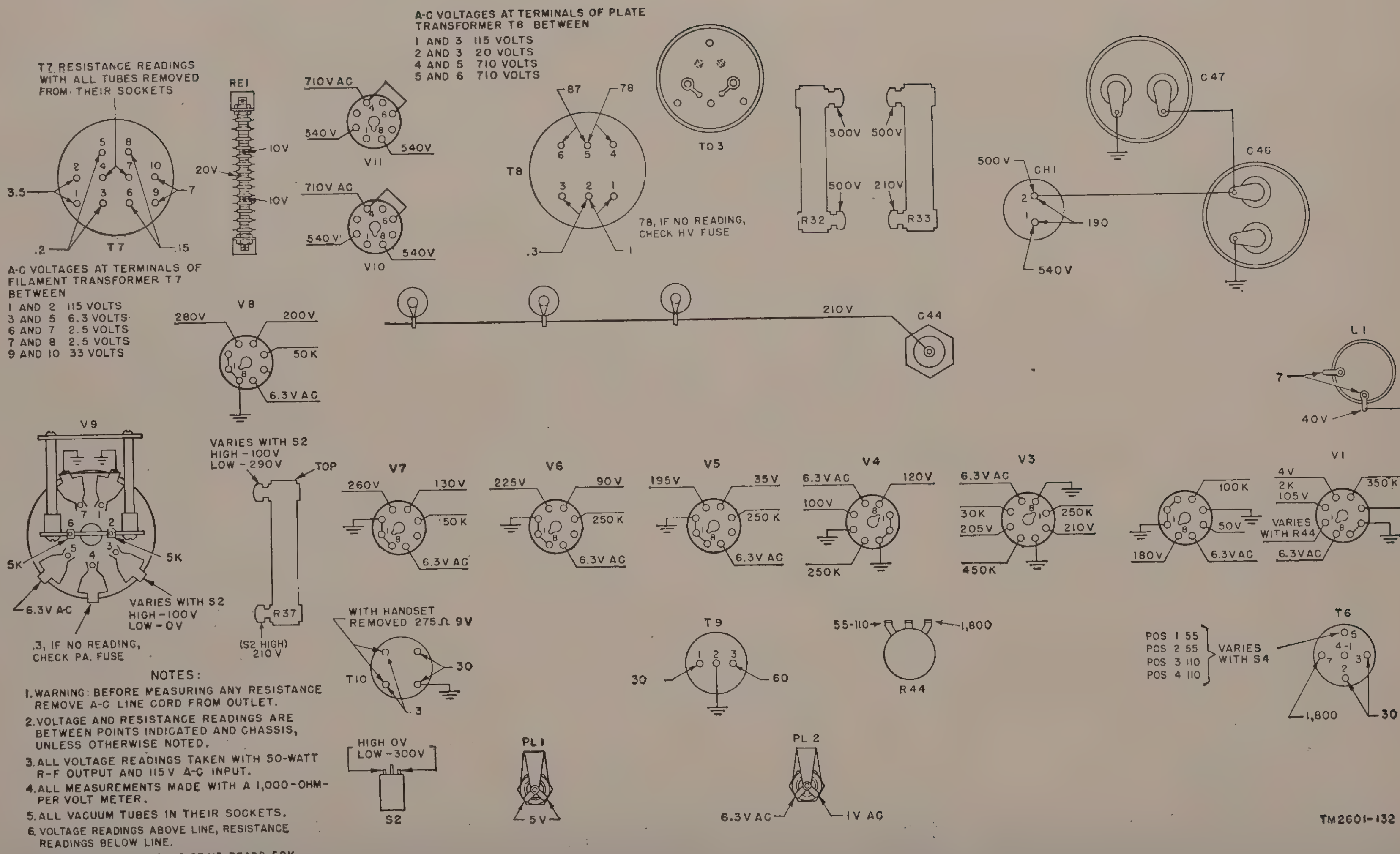
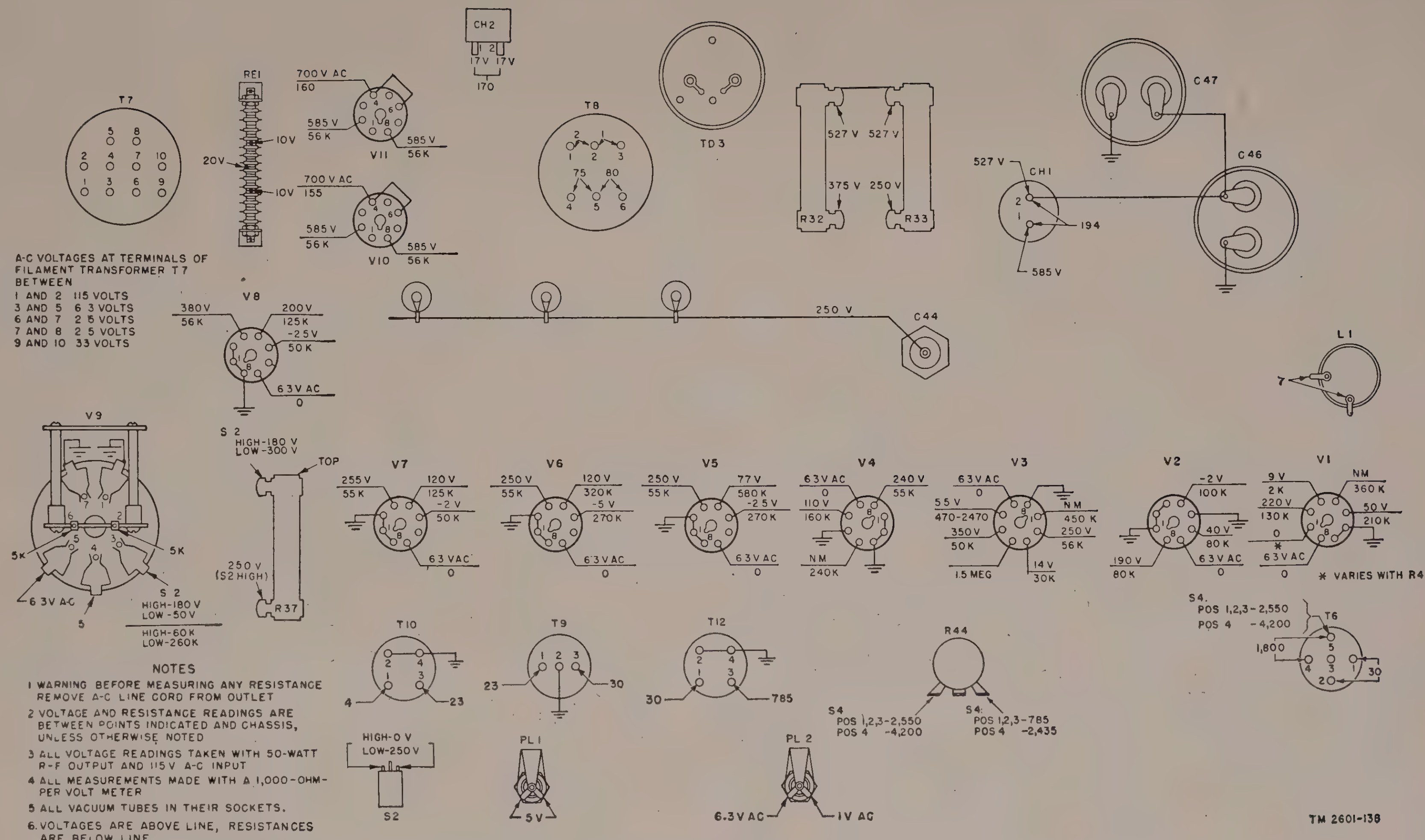


Figure 163. Voltage and resistance diagram of early transmitters.



NOTES

1 WARNING BEFORE MEASURING ANY RESISTANCE REMOVE A-C LINE CORD FROM OUTLET
2 VOLTAGE AND RESISTANCE READINGS ARE BETWEEN POINTS INDICATED AND CHASSIS, UNLESS OTHERWISE NOTED
3 ALL VOLTAGE READINGS TAKEN WITH 50-WATT R-F OUTPUT AND 115 V A-C INPUT
4 ALL MEASUREMENTS MADE WITH A 1,000-OHM-PER VOLT METER
5 ALL VACUUM TUBES IN THEIR SOCKETS.
6 VOLTAGES ARE ABOVE LINE, RESISTANCES ARE BELOW LINE

Figure 164. *Radio Transmitter T–14H/TRC–1, voltage and resistance diagram.*

(1) This reading should show about 50,000 ohms resistance. If it shows zero resistance, remove V10, and then V11. If removal of either tube results in a correct reading, replace the tube with a good one and check again.

(2) If removal of the tubes does not change the reading, check the h-v wiring and the capacitors connected to the B+ lead.

(3) Measure the resistance between either plate lead of V9 and ground. This should be about 50,000 ohms. If the resistance measures zero, check L3, L5, and the plates of C40 for a grounded point.

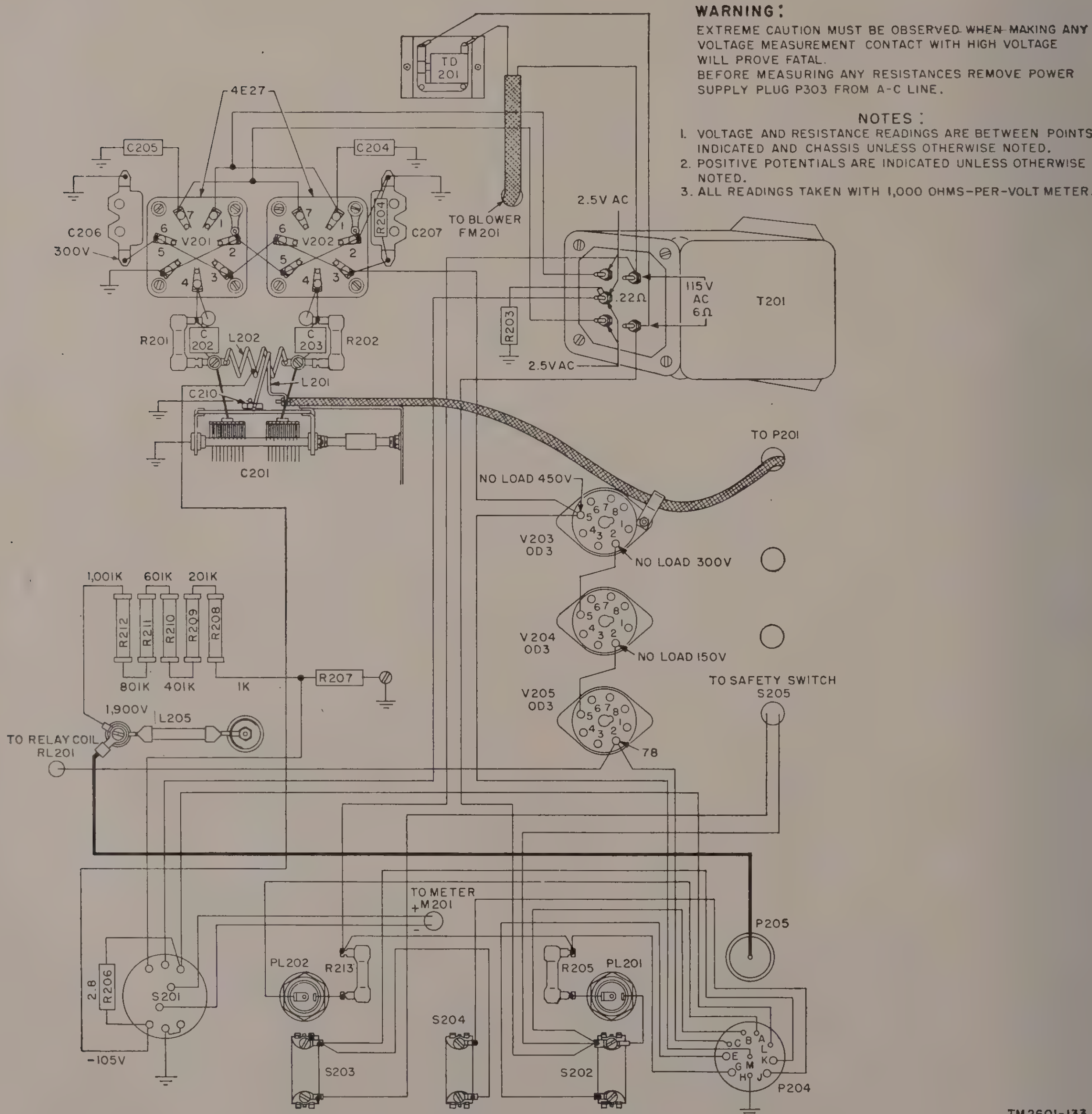


Figure 165. Amplifier AM–8/TRA–1, wiring diagram showing voltages and resistances.

WARNING: BEFORE MEASURING ANY RESISTANCES REMOVE POWER SUPPLY PLUG P303 FROM A-C LINE.
VOLTAGE AND RESISTANCE READINGS ARE BETWEEN POINTS INDICATED AND CHASSIS UNLESS OTHERWISE NOTED.
POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED.

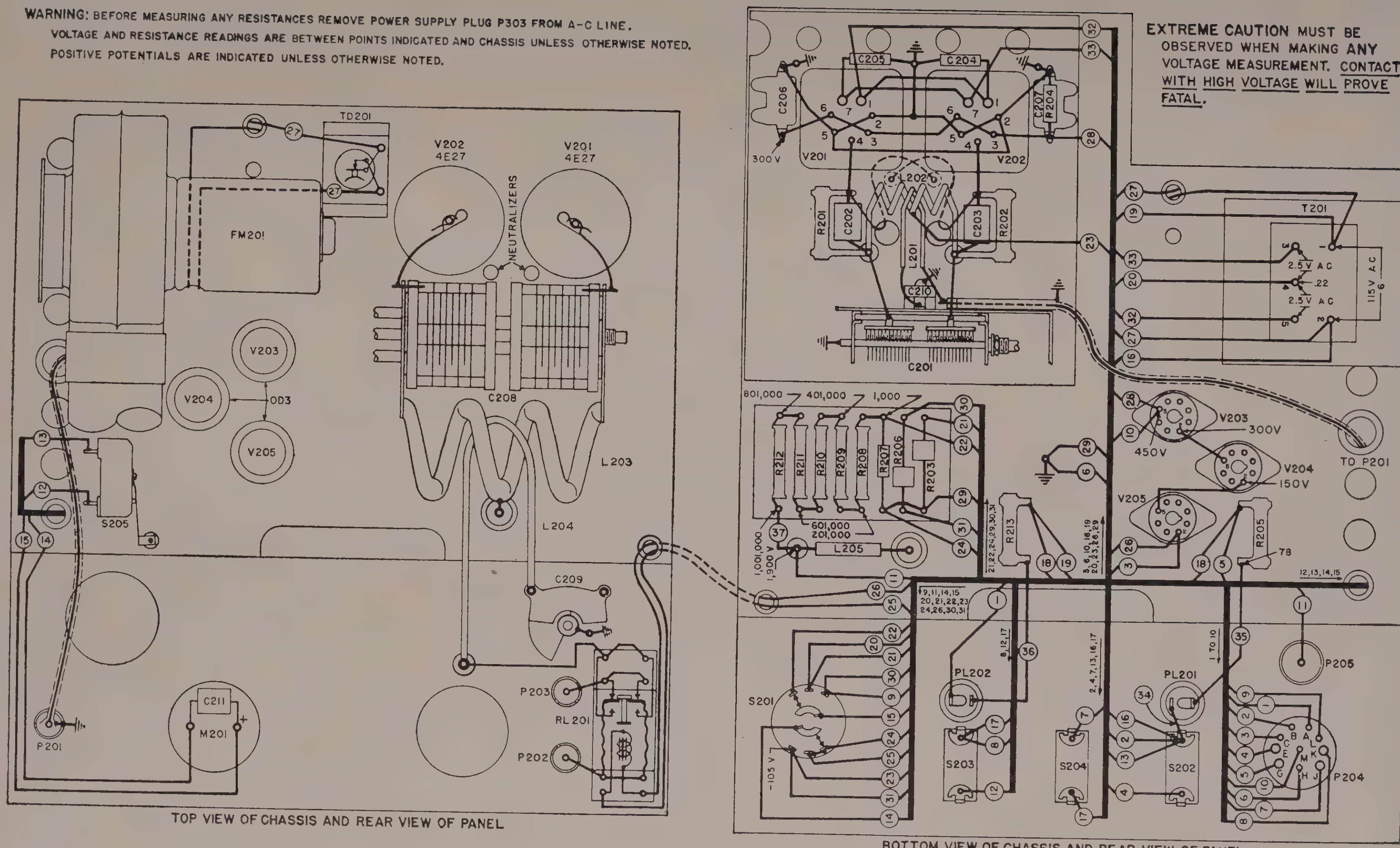


Figure 166. Amplifier AM–8B/TRA–1, wiring diagram showing voltages and resistances.

(4) If the resistance measures about 12,000 ohms, check V9 for a plate-to-grid short.

(5) The schematic of the transmitter being worked on should be consulted if the measurements do not match those of figure 163 or 164.

c. AMPLIFIER AM–8(*)/TRA–1. Make the following checks before attempting to put the amplifier into operation. Leave all cords disconnected and all tubes and dial lamps removed.

(1) The resistance between the terminals of socket P205 and ground should be more than 1 megohm. The resistance from pin M of P204 to ground should be one-half megohm. If either of these is low, check capacitors C206, C207, and C208, resistors R204 and R207 through R212, and the h-v wiring.

(2) The resistance between pin 7 of V201 or V202 and the chassis should be less than one-half ohm.

(3) Check the schematic of the amplifier worked on if the measurements do not agree with figures 165 and 166.

d. POWER SUPPLY PP–13/TRA–1. Disconnect the power supply from the amplifier and remove cord PC301 from the a-c receptacle.

(1) Measure the resistance from pin number 4 of transformer T303 and T302 to ground. The reading should be infinite. If the reading shows low resistance, remove the rectifier tubes, V302 and V303, one at a time. If the reading swings to infinity after either tube is removed, replace that tube and recheck.

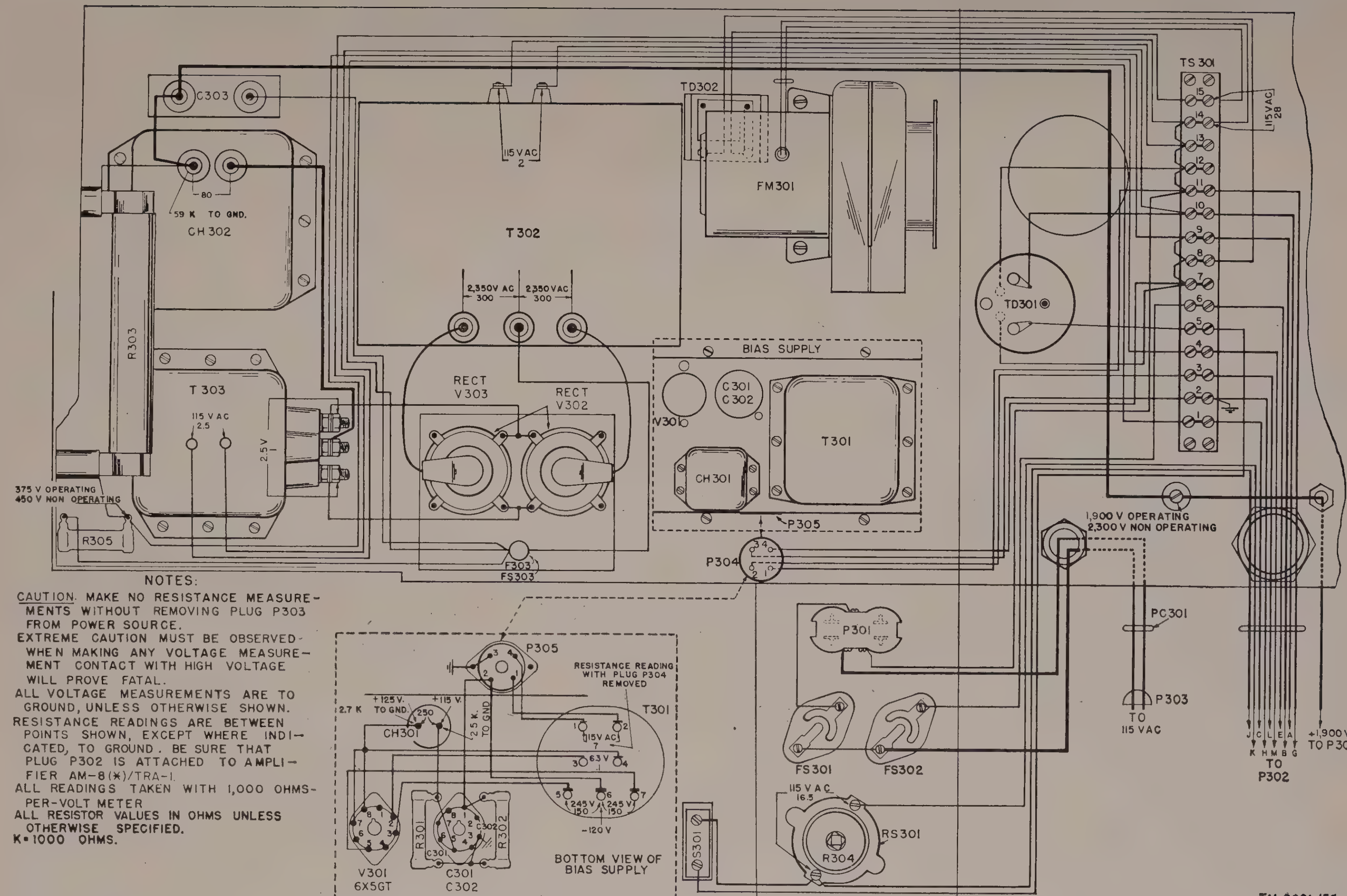
(2) Remove plug P304 and measure the resistance from pins 4 and 6 of T301 to ground. A reading of about 3,000 ohms should be obtained.

(3) If the tubes are not at fault, check capacitors C301, C302 and C303 for a short. Disconnect one lead of the capacitor under test, and measure the resistance across the capacitor. If any capacitor shows low resistance, replace it and test again.

(4) If the capacitors are good, check the h-v wiring, especially at the terminal board and at the plugs.

(5) The schematic of the power supply being worked on should be consulted if the measurements do not match figure 167.

e. TEST OSCILLATOR TS–32/TRC–1. Remove power plug P402 from the receiver power socket. Throw the CARRIER ON and MODULATION ON switches to ON. A resistance check from pin 4 of P403 to the chassis should show a minimum reading of one-fourth megohm. With the crystal removed (or in late models using capacitor C415), this reading should be infinite. Check the schematic of the set being worked on if the measurements do not agree with figure 168.



NOTES:

CAUTION. MAKE NO RESISTANCE MEASUREMENTS WITHOUT REMOVING PLUG P303 FROM POWER SOURCE.

EXTREME CAUTION MUST BE OBSERVED WHEN MAKING ANY VOLTAGE MEASUREMENT. CONTACT WITH HIGH VOLTAGE WILL PROVE FATAL.

ALL VOLTAGE MEASUREMENTS ARE TO GROUND, UNLESS OTHERWISE SHOWN.

RESISTANCE READINGS ARE BETWEEN POINTS SHOWN, EXCEPT WHERE INDICATED, TO GROUND. BE SURE THAT PLUG P302 IS ATTACHED TO AMPLIFIER AM-8(*)/TRA-1.

ALL READINGS TAKEN WITH 1,000 OHMS-PER-VOLT METER.

ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.

K=1000 OHMS.

Figure 167. Wiring diagram of early power supplies showing resistances and voltages.

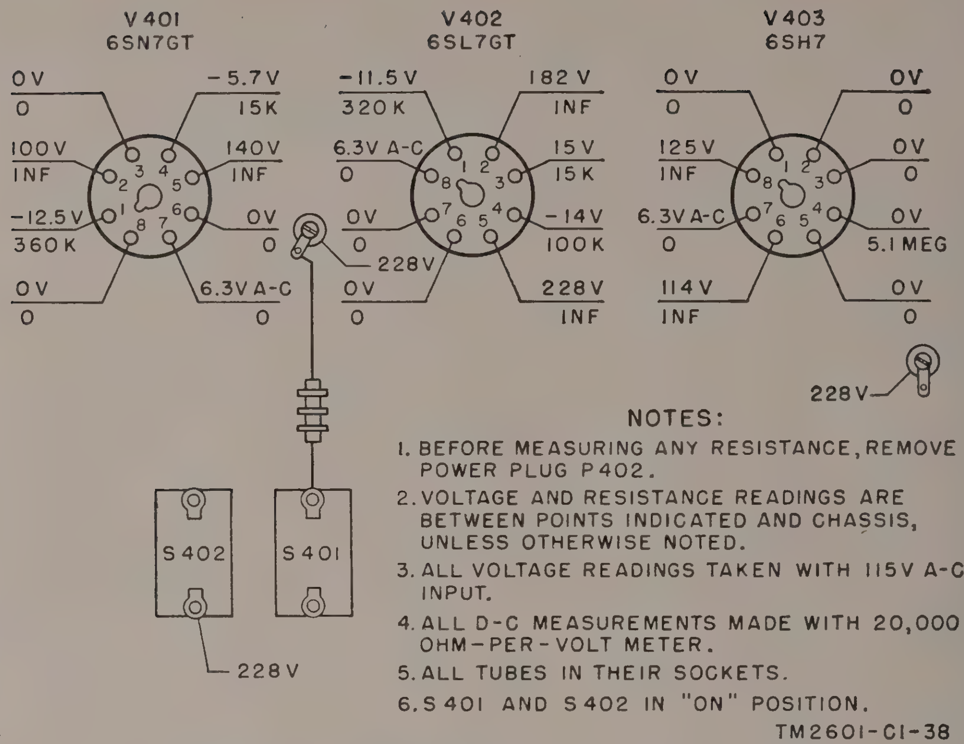


Figure 168. Test Oscillator TS–32D/TRC–1, voltages and resistances.

234. Operational Tests

a. RECEIVER R–19(*)/TRC–1. Connect Signal Generator TS–497/URR as indicated in paragraph 243. Check that the tubes and filter capacitors are in place (fig. 169). Operate the receiver as indicated in the equipment performance checklist, performing steps 1 through 7, 16, and 19 through 25. Also listen for crackling or buzzing noises which indicate h-v arcing. Check for smoke and the odor of burned or overheated parts.

b. RADIO TRANSMITTER T–14(*)/TRC–1. If the transmitter is connected to its associated components as in normal operation, operate the equipment as described in the equipment performance checklist in paragraph 172. This checklist is important because it frequently indicates the general location of trouble. Also listen for crackling or buzzing noises which indicate h-v arcing. Check the transmitter for smoke and the odor of burned or overheated parts. Check that tubes and the crystal are in place (fig. 170).

(1) If the transmitter is being checked apart from its associated components, the following procedures must be followed to make it ready for operation.
  (*a*) Turn the transmitter LINE ON-OFF switch to OFF and the TYPE OF OPERATION switch to LOCAL CONTROL.
  (*b*) Connect Indicator Subassembly MX–970/U to the ANTENNA terminal connector.

(2) To supply power to the filaments, throw the LINE ON-OFF switch to ON.

(3) To supply power for plate and screen circuits, insert the three-contact plug of the handset into the MICROPHONE jack and operate the microphone switch.

(4) Continue with the transmitter portions of the equipment performance checklist (par. 172).

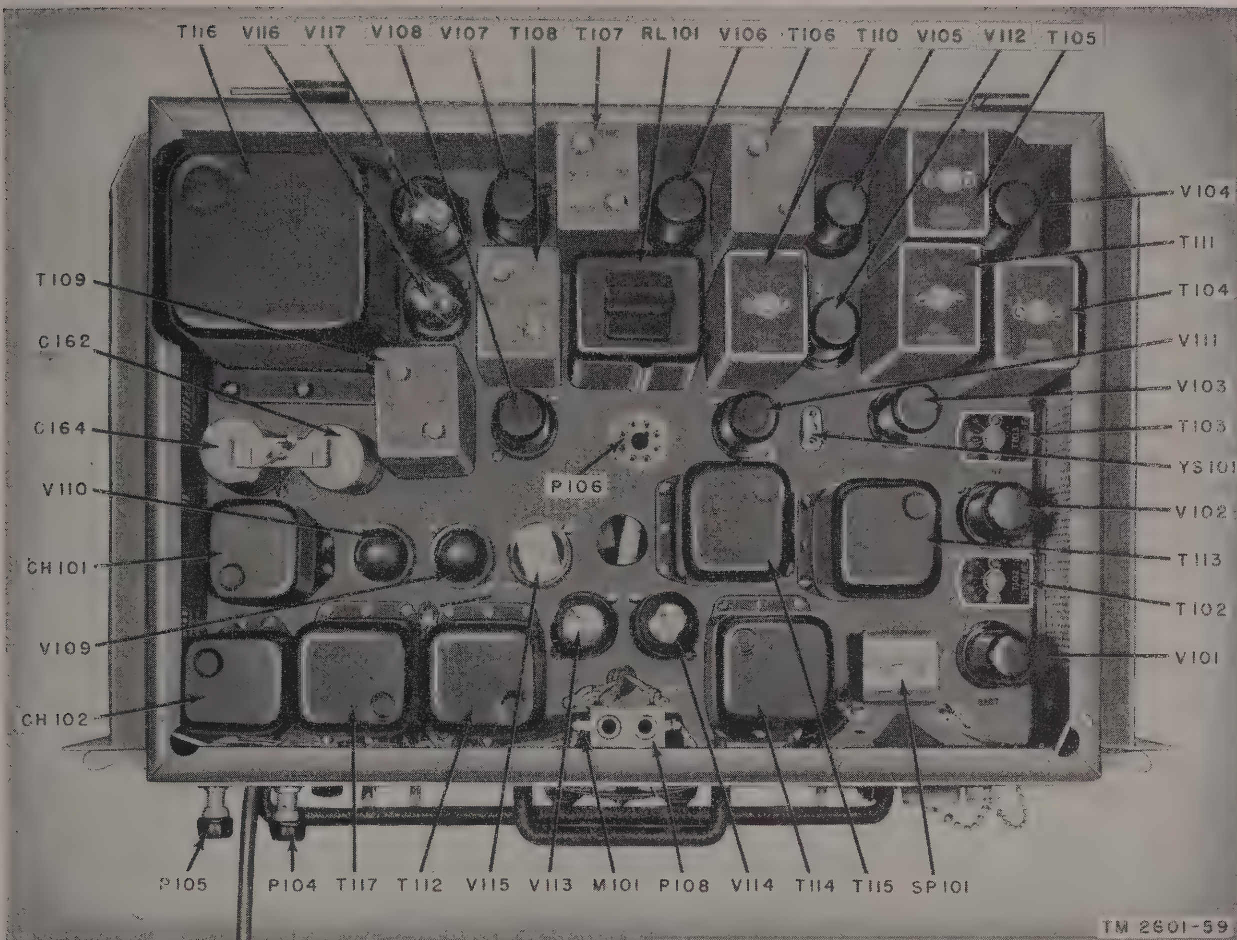


Figure 169. Radio Receiver R–19H/TRC–1 chassis, top view.

c. Amplifier AM–8(*)/TRA–1 and Power Supply PP–13(*)/TRA–1. Ordinarily, the amplifier will not be operationally tested apart from the power supply.

(1) To test the amplifier and power supply, connect the dummy antenna (Indicator Subassembly MX–970/U) to the ANTENNA receptacle on the amplifier. Throw the TUNE OPERATE switch to TUNE.

(2) Operate the amplifier as described in the equipment performance checklist, steps 15, 18, 32, 33, and 34. This checklist is important because it frequently indicates the general location of trouble. Also listen for crackling or buzzing noises which indicate h-v arcing. Check for smoke and the odor of burned or overheated parts. Refer to figures 37, 38, 171, and 172 for top views of the amplifier and power supply.

235. Trouble-Shooting Charts

The following charts (pars. 236 through 240) are supplied as an aid in locating trouble in the radio receiver, transmitter, and power pack. The charts list the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. *The chart also indicates how to localize trouble quickly to the audio, i-f, or r-f stages of the receiver.* Signal substitution tests then can be used to supplement this procedure and to determine the defective stage. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should ordinarily be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figures 161 through 168.

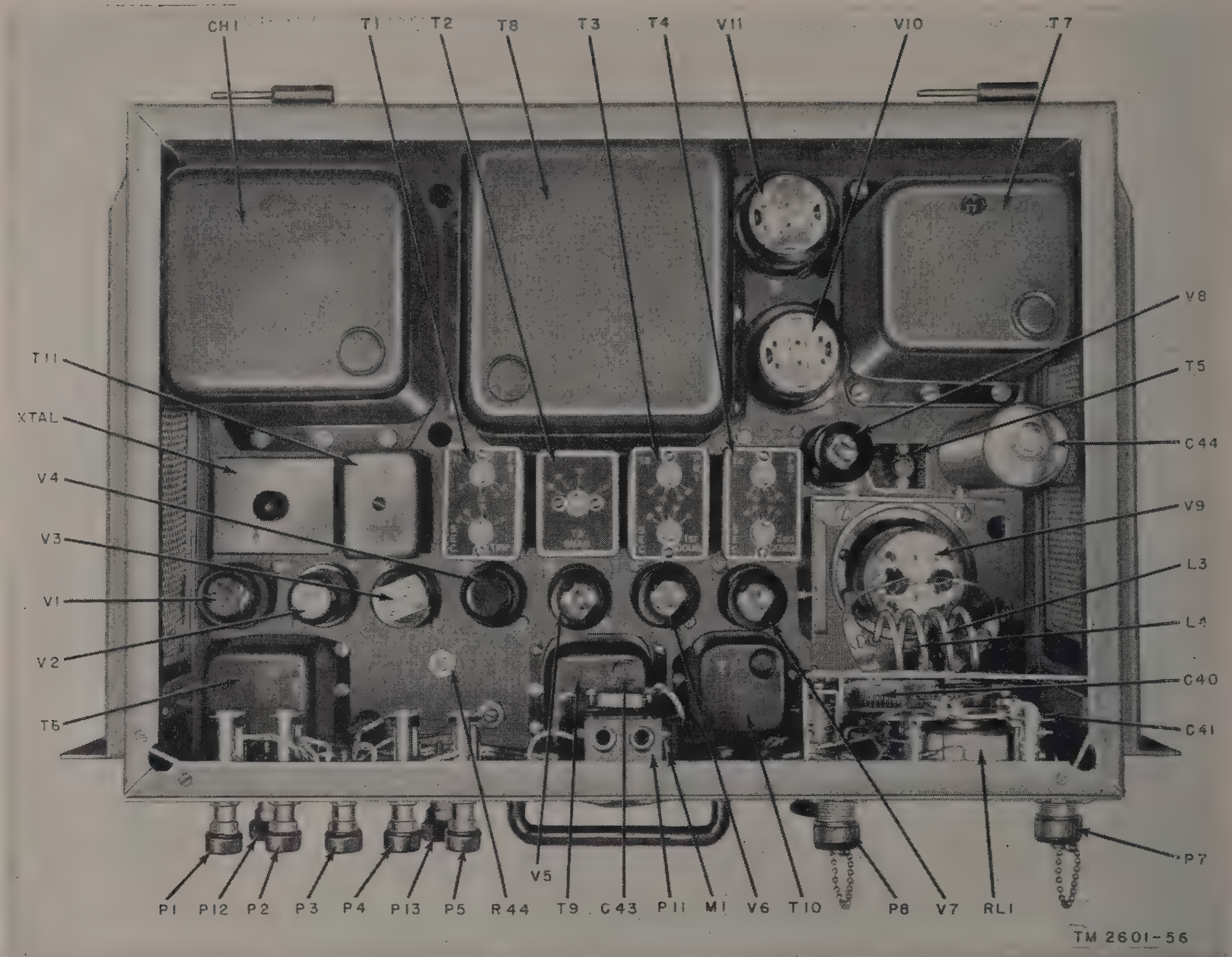


Figure 170. Radio Transmitter T–14H/TRC–1, top view.

236. Sectionalizing Trouble to Transmitter or Receiver

Symptoms	Probable trouble	Corrections
1. Transmitter and receiver dead. Pilot lamps out.	1. Power Unit PE–75–(*) inoperative	1. Check Power Unit PE–75–(*).
	Junction Box J–85/G defective	Repair.
	Cord CD–711 defective	Repair.
	Junction Box JB–110 defective	Repair.
	Equipment connected to 220 volts	Connect equipment to 110-volt a-c line. Replace fuse.
2. Equipment inoperative. Pilot lights on receiver and transmitter light.	2. Interconnecting cables improperly connected or connectors not making good contact.	2. Check interconnecting cables and tighten connectors.
	Controls on receiver and transmitter not properly set for operation.	Check control settings and reset if necessary.
	Defective tubes	Replace defective tubes. Check meter readings to help determine defective tube.

Symptoms	Probable trouble	Corrections
3. Receiver and transmitter in same direction operative, but communication poor.	3. Intervening terrain causes excessive attenuation of signal.	3. Select better operating sites.
	Antennas not directed properly	Check antenna direction.
	Antenna polarization not the same	Check antenna polarization at both locations.
4. Receiver dead. Pilot lamp out	4. Fuse F101 blown	4. Replace fuse. Repair.
5. Transmitter dead. Pilot lamp out	5. LINE ON-OFF switch snapped. OFF or defective.	5. Throw ON. Repair.
	Poor connection into Junction Box JB–110.	Check.
6. Receiver dead. Pilot lamp lit. No meter readings.	6. Defective receiver	6. Repair.
7. Transmitter dead. Pilot lamp lit	7. Defective transmitter	7. Repair.
8. Receiver dead. Pilot lamp lit. Meter readings not normal.	8. Squelch circuit out of adjustment	8. Readjust.
	Squelch relay R101 inoperative	Repair or replace.
9. Transmitter dead. Pilot lamp on	9. Relay RL101 inoperative	9. Repair or replace.
10. Receiver signal weak. Meter readings normal.	10. Open or shorted coaxial cable	10. Replace.
11. No transmitter output. Meter readings normal.	11. Open or shorted coaxial cable or dipole faulty.	11. Replace.

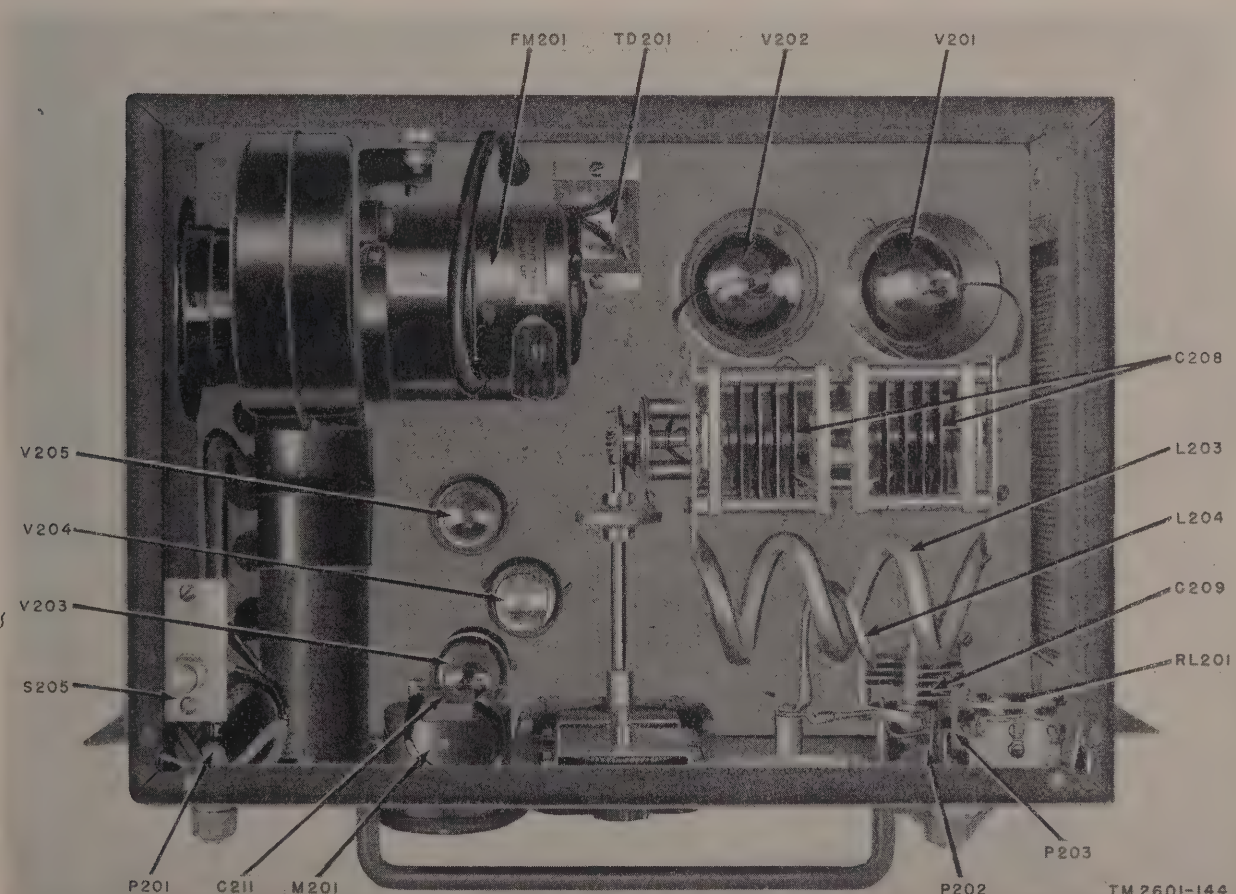


Figure 171. Amplifier AM–8A/TRA–1 chassis, top view.

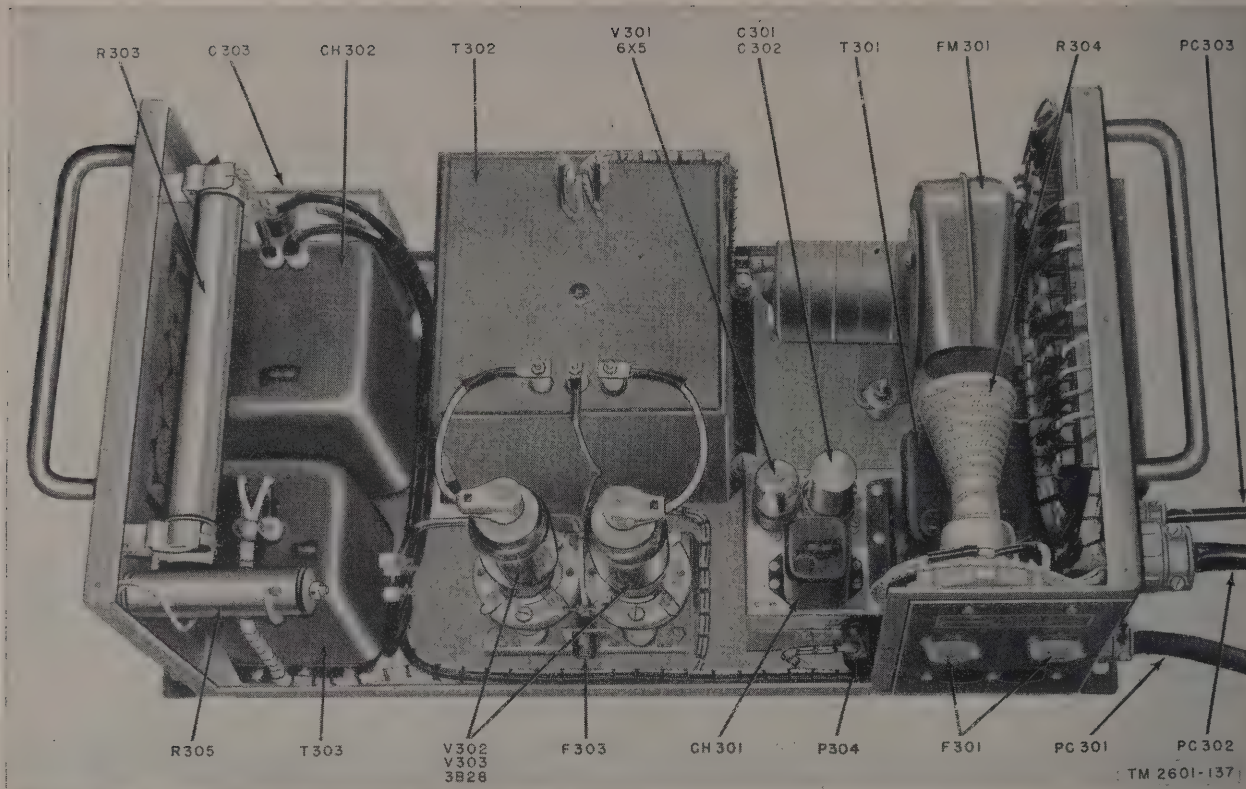


Figure 172. Late model of Power Supply PP–13D/TRA–1 chassis, top view

237. Localizing Receiver Trouble

a. If the receiver fails to operate within 1 minute after switch S103 has been turned on, see whether the tubes show signs of heating. If they remain cold, check fuse F101 in fuse holder FS101. If the fuse shows no signs of being blown, check it with a continuity meter to make sure that it is not defective, or replace it with a spare fuse.

b. If, when the receiver is turned on and the SQUELCH switch is OFF, a loud rushing sound is heard from the loudspeaker or headphones, the receiver may be operating normally, but the tuning may be at fault. Check to see that the tuning controls are in the proper positions and check the receiver tuning (par. 131).

c. If the receiver fails to make the loud rushing noise described above, check the tubes to see if any are burned out. Replace any tubes which seem defective. The tubes should be checked first when the receiver fails to operate, since they are the most fragile parts of radio equipment and most likely to wear out.

d. Location of trouble in the receiver is made more difficult, because the individual r-f stages are not all metered. Any one of the stages, V101 through V107, V111, or V112, could be responsible for an improper reading on the tuning meter in METER SWITCH position 1 or 2. If trouble develops in any one of these stages, and defective tubes or misalinement are not the cause, each stage will have to be given an individual resistance and voltage check and compared to the readings of the voltage and resistance charts (figs. 161 through 168).

e. When trouble shooting, the settings of tuned circuits T106, T107, T108, and T109 should not be disturbed except as a last resort. If there is a definite sign or trouble in those particular stages, refer to paragraph 131 for the proper tuning procedure.

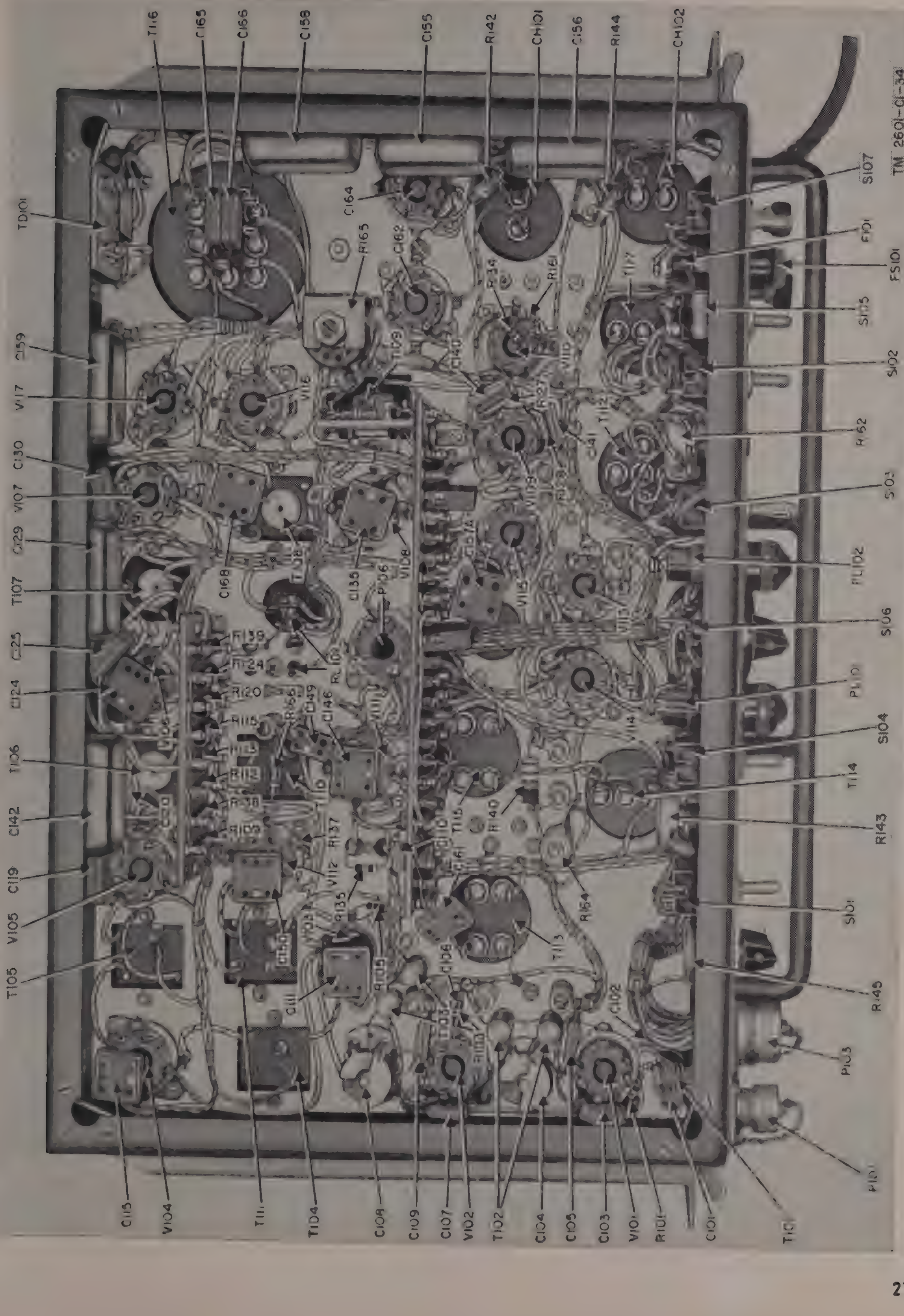


Figure 173. Radio Receiver R-19II/TRC-1 chassis, bottom view

Symptoms	Probable trouble	Corrections
1. Line fuse F101 blown	1. Shorted or leaky filter capacitor C162, C163, or C164.	1. Replace.
	Short circuit in fan motor circuit	Replace defective part.
	Short circuit in plate, screen, or filament circuit of any tube.	Replace defective part.
	Defective rectifier tube V116 or V117	Replace.
2. No plate or filament voltage	2. Line fuse F101 blown	2. Replace.
	Poor contact of a-c line plug	Replace.
	Defective line switch S103	Replace.
	Defective power cord PC101	Repair.
3. No filament voltage (plate voltage normal).	3. Open lead in filament circuit	3. Repair.
4. No plate voltage (fuse not blown)	4. Open circuit in power supply	4. Repair.
	Defective rectifier tube V116 and V117	Replace.
5. High hum level in output	5. Defective filter choke CH101 or CH102	5. Replace.
	Defective filter capacitor C162, C163, or C164.	Replace.
	Defective line bypass capacitor C165 or C166.	Replace.
	RECEIVER OUTPUT terminal P104 or P105 grounded.	Repair or replace.
6. Low or no first limiter grid current (positions 1 and 2 on METER SWITCH).	6. No r-f input at ANT. INPUT connector P101.	6. Check antenna input cable.
	Defective crystal	Replace.
	Crystal makes poor contact in crystal socket.	Clean contacts, and replace crystal in socket.
	Wrong crystal for frequency being received.	Place correct crystal in socket.
	Squelch control setting incorrect	Check setting of SQUELCH.
	Defective meter	Replace.
7. Low or no second limiter grid current (position 3 on METER SWITCH); first limiter reading normal.	7. Defective second limiter stage (transformer T108, plate circuit of V107, or circuits of tube V108).	7. Repair or replace.
	Defective meter	Replace.
8. Discriminator will not balance (positions 4 and 5 on METER SWITCH); first and second limiter stages normal.	8. Discriminator stage defective (plate circuit of V108, discriminator transformer T109, or circuits of V109).	8. Repair or replace.
	Defective meter	Replace.
9. Low or no audio output in speaker	9. SPEAKER ON-OFF switch S101 at OFF position.	9. Turn switch ON.
	Defective speaker	Replace.
	Defective SPEAKER VOLUME control R145.	Replace.
	Defective audio transformer T113 or T115.	Replace.
	Defective filter T114	Replace.
	SQUELCH ADJUST control R153 incorrectly set.	Reset.
10. Speaker output distorted	10. Speaker cone damaged	10. Replace.
	Discriminator tuning incorrect	Retune.
11. Audio output at RECEIVER OUTPUT terminals distorted.	11. Terminal P104 or P105 grounded	11. Repair or replace.
	Discriminator detuned	Retune.
12. Squelch inoperative	12. Squelch relay defective	12. Repair.
	Defective SQUELCH switch S102	Replace.
	Defective SQUELCH ADJUST control R162.	Replace.
	Receiver sensitivity low	Check alinement and tubes.
	No r-f input at ANT. INPUT connector	Check antenna.

237. Localizing Receiver Trouble—(Continued)

Symptoms	Probable trouble	Corrections
13. Erratic noise in audio output	13. Oscillation in set (defective bypass capacitor or improper tuning).	13. Replace capacitor or retune.
	Interference from other radio sets	Check interference charts. (figs. 90 through 98).
	Intermittent contact in the receiver (bad tube or loose connections).	Repair.
14. Low or no audio output at RECEIVER OUTPUT terminals.	14. SQUELCH ADJUST control incorrectly set.	14. Reset.
	AUDIO GAIN control turned down	Rotate AUDIO GAIN clockwise.
	Defective AUDIO GAIN control R143	Replace.
	Channel switch S104 in SINGLE CHANNEL position.	Reset switch.
	Defective channel switch S104	Replace.
	No output from discriminator	Check discriminator.
15. No audio output reading on db meter (position 6 of METER SWITCH).	15. No audio output at RECEIVER OUTPUT terminals.	15. Check tube V113.
	Meter rectifier RE101 defective	Replace.
	Defective meter	Replace.

238. Localizing Trouble in Transmitter

If the cause of failure is not readily traced to misalinement or defective tubes and is not apparent from visual inspection, then carefully note all the symptoms of the trouble and see the chart below.

Symptoms	Probable trouble	Corrections
1. Line fuse blown	1. Short in filament transformer T7	1. Replace.
	Short in plate transformer T8	Replace.
	Short in fan circuits	Repair.
2. H-v fuse blown	2. Shorted capacitor C44, C45, C46, or C47.	2. Replace.
	Shorted variable tuning capacitor	Repair or replace.
	Shorted bypass capacitors	Replace.
	Grounded wiring or filter choke	Replace or repair.
3. Power-amplifier cathode fuse F1 blown	3. Plate circuit of V9 detuned	3. Retune for minimum (par. 130).
	Failure in drive to V9 (due to tube failure or crystal failure).	Check and replace damaged part.
	Defective grid leak capacitor C36 or C37.	Replace.
	Shorted coaxial cable	Replace.
4. No plate voltage (not due to blown fuse or short circuit).	4. Open circuit in transformer T7 or T8	4. Replace.
	Open circuit in choke CH1	Replace.
	Open plate-dropping resistor R32 or R33.	Replace.
	Defective antenna transfer and plate control relay RL1.	Repair or replace.
	Defective plate thermal relay TD3	Replace.
	Defective selenium rectifier RE1	Replace.
	Defective TYPE OF OPERATION switch S4.	Replace.
	Defective rectifier tubes V10 and V11	Replace.
5. No filament voltage (not due to blown fuses).	5. Defective filament transformer T7	5. Replace.
	Open lead in filament circuits	Repair.

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Symptoms	Probable trouble	Corrections
6. Low plate voltage and low filament voltage.	6. Line voltage low	6. Check power source at P14 socket.
7. No filament or plate voltage (not due to blown fuses).	7. Defective line switch S1	7. Replace.
	Poor contact of a-c line plug P14	Check contact.
	Open or shorted a-c line cord	Repair.
	Loose or open wires	Repair.
8. Set overheats	8. Dust-clogged air intake filters	8. Clean or replace.
	Defective fan	Replace.
	Partial shorts in power supply causing excessive load on power transformer.	Repair.
9. Transmitter is microphonic	9. Defective crystal	9. Replace.
	Defective tube V1, V2, or V3	Replace.
10. Handset not receiving	10. Control cable defective	10. Replace.
	Headset jack J2 defective	Repair.
11. Tuning indicator M1 fails to read (voltages normal, stages tuned).	11. Defective meter	11. Replace.
	Meter pointer sticking	Tap on meter glass or replace.
	Meter circuit open	Repair.
	METER SWITCH S3 defective	Repair.
12. Meter readings low	12. Tube deterioration	12. Replace.
13. Meter readings incorrect	13. Low line voltage	13. Check power source.
	Stage not properly tuned	Retune.
	Defective meter shunt R34 or R35	Replace.
14. High-fidelity frequency response not uniform causing one or more channel levels to be affected during multi-channel system operation.	14. High-fidelity cable terminal P1, P2, P4, or P5 grounded through the lightning protector blocks.	14. Repair.
15. Motorboating from input at TRSG. terminals.	15. CABLE COMPENSATOR gain control R4 setting too high.	15. Reset.
16. High hum level introduced in input at TRSG. terminals.	16. Binding post P4 or P5 grounded through lightning protector A3 or A4.	16. Replace protector units.
17. High hum level introduced in local microphone input at jack J1.	17. Defective selenium rectifier filtering. Check R40, R41, R47, C50 and CH2.	17. Replace defective part.
18. High hum level in both microphone circuit and high-fidelity input.	18. A-c line filter C48 or C49 defective	18. Replace capacitors.
	Transmitter not grounded	Ground transmitter.
19. Transformer T1 does not tune (power supply voltages normal).	19. No crystal in oven	19. Place crystal in oven.
	Crystal not making good contact in socket.	
	Defective tubes V1, V2, V3, and V4	Replace.
	Open or short in circuits of V1, V2, V3, and V4.	Repair.
	Defective crystal	Replace.
20. One of the stages (T2, T3, T4, or T5) fails to tune.	20. Defective tube	20. Replace.
	No drive from previous stage	Retune previous stage.
	Open or shorted bypass capacitor, tuning capacitor, or coupling capacitor.	Repair or replace.
	Open or shorted resistors	Replace.
	Defective r-f coils in preceding stage	Replace.
21. Power amplifier V9 fails to tune	21. No or low grid drive	21. Retune preceding stages.
	Transmitter not tuned properly	Retune.
	Defective power-amplifier tube V9	Replace.
	Defective grid-leak resistors or capacitors.	Replace.
	Defective plate tuning capacitor C40 or plate coil L3.	Repair.

Symptoms	Probable trouble	Corrections
22. No r-f output from transmitter	22. Defective antenna loading capacitor C41.	22. Replace.
	Defective antenna coupling capacitor C42.	Replace.
	Defective antenna coupling coil L4	Replace.
	Defective contacts on antenna transfer and plate control relay RL1.	Repair or replace.
	Defective ANTENNA connector P7	Replace.
	Defective antenna equipment	Repair or replace.
23. No modulation through TRSG. terminals.	23. Defective input transformer T6	23. Replace.
	Defective CABLE COMPENSATOR R4.	Replace.
	Binding post P4 or P5 shorted to ground through lightning protectors.	Replace lightning protectors.
	Open resistor R3 or R5	Replace.
	Jumper from REC. terminals to TRSG. terminals missing (in relay operation).	Connect jumper wire.
	Control cable defective (in relay operation).	Replace.
24. No modulation from local microphone circuit.	24. Bad contacts in microphone jack J1	24. Repair.
	Defective selenium rectifier RE1	Replace.
	Open or shorted rectifier filter network	Repair.
	Defective filament transformer T7	Replace.
	Defective low-pass filter T9	Replace.
	Defective TYPE OF OPERATION switch S4.	Replace.
	Defective CABLE COMPENSATOR R4.	Replace.
	Defective microphone transformer T10 or T12.	Replace.
	Defective handset	Replace.
25. Noisy operation of fan FM1	25. Fan blades loose on shaft	25. Tighten blades.
	Transmitter cover not fastened tightly	Fasten cover.
26. Fan motor does not operate (when temperature is high enough).	26. Fan thermal relay TD2 defective	26. Replace.
	Defective fan motor	Replace.
	Bad contact of fan connector P10 or P11	Repair or replace.

239. Localizing Trouble in Amplifier and Power Supply

Warning: Use extreme caution when servicing the amplifier and power supply. Contact with the high voltage is fatal.

a. If the failure is not caused by detuning or by defective tubes and is not apparent from visual inspection, all the symptoms of the trouble should be noted and reference made to the voltage and resistance diagrams (figs. 165 through 167) and to the chart below.

b. The case of the power supply must be removed before servicing. Remove the screws in the case and disconnect the door safety switch S301 screwed on the front of the case. In order to operate the power supply with the case removed, improvise some means for holding the door safety switch, S301, closed, or short out the switch.

c. To check the amplifier independently of the antenna, a 250-watt, 120-volt incandescent lamp can be used as a load (in Indicator Subassembly MX–970/U). The lamp should light to full brilliancy if the amplifier is operating normally and is tuned up according to the procedure described in paragraph 132. A lamp of this type will serve as a dummy load for only a few minutes at a time before the h-f currents cause it to overheat or start a corona discharge.

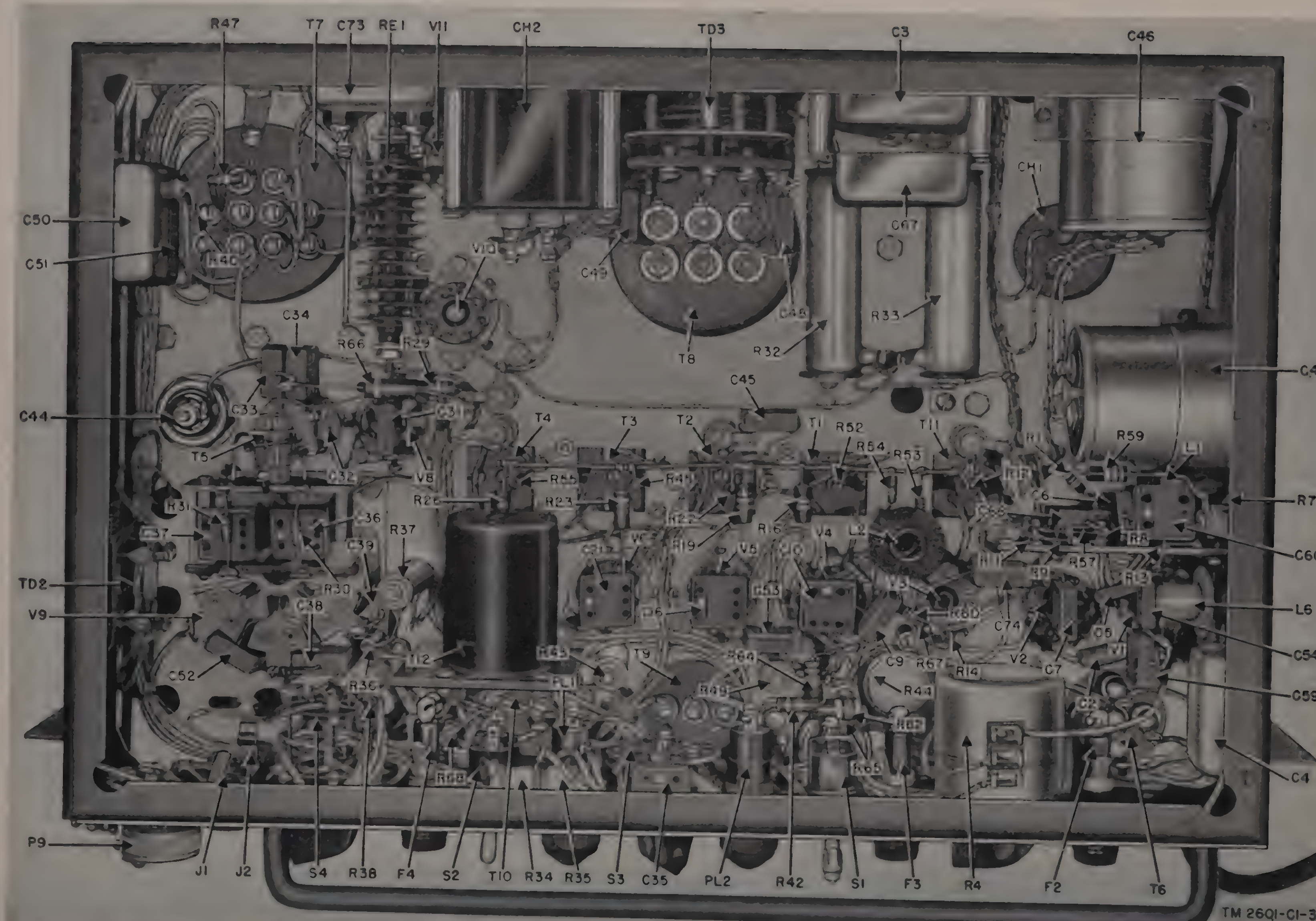

Figure 174. Radio Transmitter T-14H/TRC-1, chassis, bottom view.

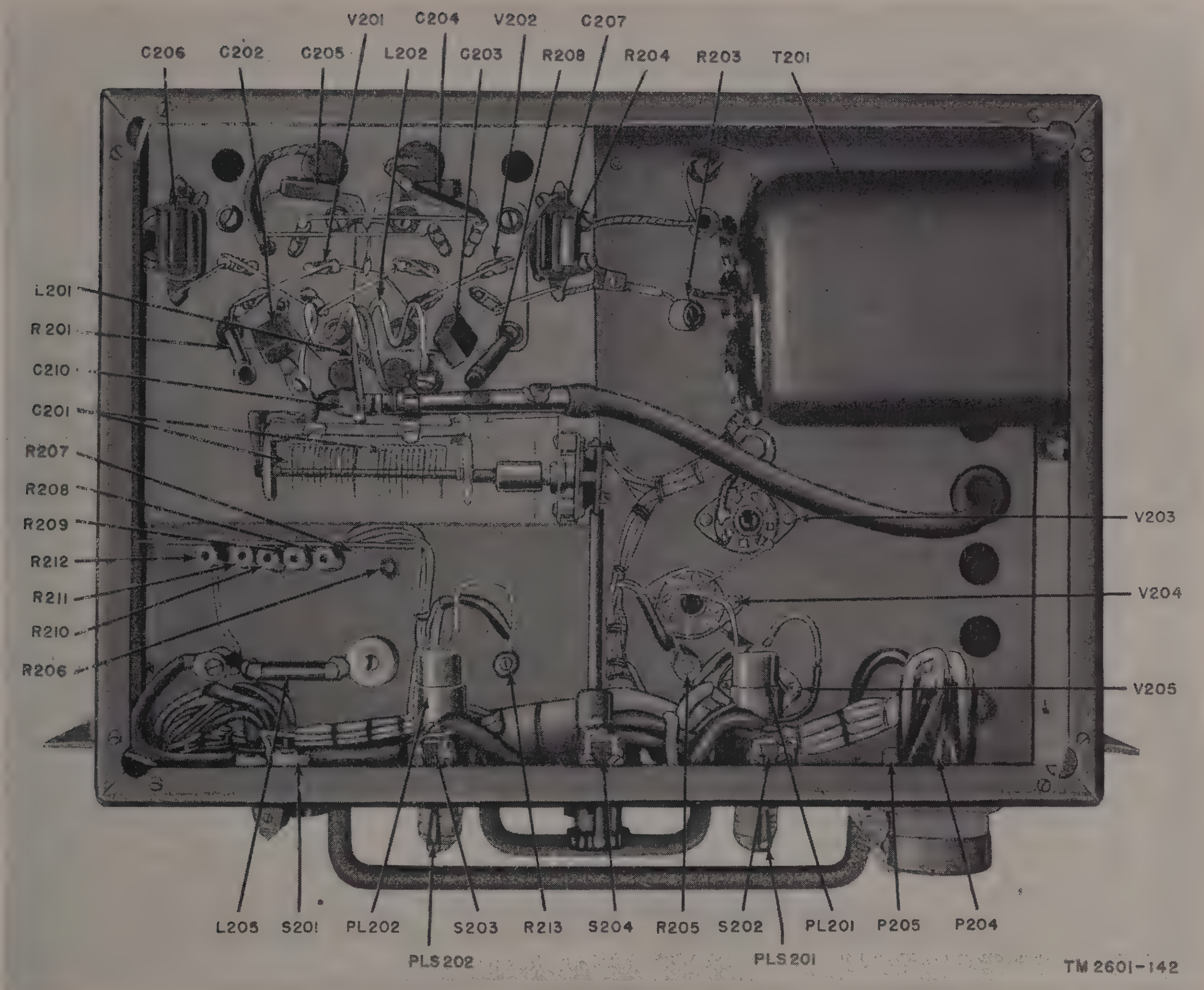

Figure 175. Amplifier AM–8(*)/TRA–1 chassis, bottom view.

239. Localizing Trouble in Amplifier and Power Supply—(Continued)

Symptoms	Probable trouble	Corrections
1. H-v fuse F303 blown	1. Failure in grid bias	1. Check bias supply.
	Amplifier plate circuit detuned	Tune amplifier plate circuit.
	Short circuit in capacitor C303	Replace.
	Defective resistors R303 and R305	Replace.
	H-v cable shorted	Replace.
	Shorted screen bypass capacitor C206 or C207.	Replace.
	Defective grid-leak resistors or capacitors.	Replace.
	Defective plate tuning capacitor C208.	Repair or replace.
	Defective amplifier plate tuning coil L203.	Repair or replace.
	Defective interconnecting power cable.	Replace.
	Defective antenna loading capacitor C209.	Replace.
	Defective antenna coupling coil	Repair.

Symptoms	Probable trouble	Corrections
2. Line fuse blown	2. Shorted transformer T302, T303, T201, or T301.	2. Replace.
	Short in tube V302 or V303	Replace.
	Defective interconnecting power cable.	Replace.
	Shorted filter capacitor C301 or C302.	Replace.
3. No plate voltage, filament voltage normal (no fuse blown).	3. Defective thermal relay TD301	3. Replace.
	Defective door safety switch S205 or S301.	Repair or replace.
	Open circuit (plate lead, transformer, capacitor or resistor).	Repair.
	Defective plate ON OFF switch S203.	Replace.
	Defective interconnecting power cable.	Replace.
4. No plate or filament voltage	4. Defective filament ON OFF switch S202.	4. Replace.
	Defective line cord (or pin plug contact).	Repair or replace.
5. No screen voltage, plate voltage normal.	5. Defective interconnecting power cable.	5. Replace.
	Defective resistor R303 or R305	Replace.
6. No grid bias voltage (no fuse blown)	6. Defective interconnecting power cable.	6. Repair or replace.
	Open circuit in bias supply	Repair.
7. Low or no grid drive	7. Failure in excitation from transmitter.	7. Check transmitter tuning.
	Defective capacitor C210 or coil L201.	Check interconnection cables. Replace.
	Defective tuning capacitor C201	Repair or replace.
	Grid circuit detuned	Retune.
	Defective coaxial cable	Replace.
8. No or low r-f output	8. Plate circuit detuned	8. Retune.
	Defective coil L204 or capacitor C209.	Repair or replace.
	Defective antenna transfer relay RL201.	Repair or replace.
	Low or no grid drive	Check input from transmitter.
	Defective coaxial cable to antenna	Replace.
	Low line voltage	Check power source.
9. Excessive cathode current	9. Plate circuit detuned	9. Retune.
	Failure in grid drive	Check transmitter input.
	Defective grid-leak bias resistor or capacitor.	Replace.
	Defective plate tuning capacitor C208.	Repair or replace.
	Defective plate coil L203	Repair or replace.
	Meter shunt R203 defective	Replace.
10. Chattering antenna transfer relay RL201 and appreciable reading of cathode current with power amplifier in standby.	10. Oscillation	10. Check screen-grid circuit of power amplifier.
11. Blower does not go on when equipment is hot.	11. Defective ventilating control thermostat TD201 or TD302.	11. Replace.
12. Meter readings low or incorrect	12. Low line voltage	12. Check power source.
	Defective meter shunt R203 or R206.	Replace.

239. Localizing Trouble in Amplifier and Power Supply—(Continued)

Symptoms	Probable trouble	Corrections
13. No meter readings (voltages normal).	13. Defective meter M201	13. Replace.
	Meter pointer sticks	Tap glass to loosen or replace meter.
	Open meter circuit	Repair.
	Defective METER SWITCH S201	Replace.

240. Localizing Trouble in Test Oscillator

Symptoms	Probable trouble	Corrections
1. No carrier	1. CARRIER-ON switch turned off	1. Snap CARRIER-ON switch to ON position.
	Defective crystal	Replace crystal.
	Defective tubes	Replace tube V401 or V402.
	TUNING knob not set to correct frequency.	Reset TUNING knob to correct frequency.
	Power supply cord not properly plugged into receiver.	Check power supply cord connection to receiver.
	Coaxial cable not properly connected to receiver or oscillator.	Check coaxial lead connections at receiver and oscillator.
	Defective receiver	Check the receiver.
	S401 defective	Replace.
	C418 (D model only) shorted	Replace.
2. Carrier on but no modulation	2. MODULATION-ON switch in off position.	2. Snap MODULATION-ON switch to ON.
	Defective tube V403	Replace.
	Defective MODULATION-ON Switch S402.	Replace.
3. No plate or filament voltage	3. Defective power supply cable	3. Repair.
	Defective receiver	Repair.
4. Filament voltage normal but no plate voltage.	4. Shorted bypass capacitor C414	4. Replace.
	Open r-f choke L402	Replace.
	Shorted capacitor C408 or C418	Replace.
	Shorted tuning capacitor C407	Repair or replace.
5. No voltage at pin 2 of V401	5. Open r-f choke L403	5. Replace.
	Open filter resistor R402	Replace.
	Shorted bypass capacitor C417	Replace.
	Defective crystal oscillator-buffer amplifier tube V401.	Replace.
6. No voltage at pin 5 of V401	6. Open plate resistor R404	6. Replace.
	Defective crystal oscillator-buffer amplifier tube V401.	Replace.
7. No voltage at pin 2 of V402	7. Open plate resistor R410	7. Replace.
	Defective phase modulator-frequency multiplier tube V402.	Replace.
8. No voltage at pin 5 of V402	8. Open primary of output tuning transformer T401.	8. Replace.
	Shorted tuning capacitor C407	Repair or replace.
	Shorted bypass capacitor C408 or C418.	Replace.
9. No voltage at pin 8 of V403	9. Open plate resistor R411	9. Replace.
	Open voltage divider resistor R412	Replace.
10. No voltage at pin 6 of V403	10. Open screen resistor R417	10. Replace.
	Shorted screen bypass capacitor C413.	Replace.

240. Localizing Trouble in Test Oscillator—(Continued)

Symptom	Probable truoble	Corrections
11. Plate and filament voltages normal but no carrier.	11. Defective crystal	11. Replace.
	Open r-f choke L401	Replace.
	Shorted phasing capacitor C401	Replace.
	Open isolating capacitor C416	Replace.
	Open grid resistor R401	Replace.
	Defective crystal oscillator-buffer amplifier tube V401.	Replace.
12. Plate and filament voltages normal, carrier on but no modulation.	12. Open or shorted phasing capacitor C409, V410, or C411.	12. Replace.
	Open or shorted grid coupling capacitor C412.	Replace.
	Open phasing resistor R413, R414, or R415.	Replace.
	Open grid resistor R416	Replace.

241. D-c Resistances of Coils and Transformers

The d-c resistances of coils and transformer windings are listed below. Due to the differences in the magnetic properties of iron cores, components made by different manufacturers may vary considerably in number of turns and thus in resistance.

a. TRANSMITTER.

Transformer or coil	Terminals	Ohms
CH1	1–2	164.
CH2	1–2	194.
L1		97 ± 20%.
L2		36.
L3		Less than 0.1.
L4		Less than 0.1.
L5		0.25.
L6		97 ± 20%.
L7		1.1 ± 20%.
*L8		Less than 0.1.
*L9		Less than 0.1.
*L10		Less than 0.1.
*L11		Less than 0.1.
RL1 coil		280.
T1	2–3	1.8.
T2	2–3	0.1.
T3	2–3	Less than 0.1.
T4	2–3	Less than 0.1.
T5	Primary	Less than 0.1.
	Secondary	Less than 0.1.
T6	Primary	33.
	Secondary	1,800.
T10	1–2	3.
	3–4	32.
T12	1–2	43.
	3–4	860.

*Used in some H models.

b. RECEIVER.

Transformer or coil	Terminals	Ohms
CH101	1–2	200 ± 15%.
CH102	1–2	200 ± 15%.
T101	Primary	Less than 0.1.
	Secondary	Less than 0.1.
T102	Primary	Less than 0.1.
	Secondary	Less than 0.1.
T103	Primary	Less than 0.1.
	Secondary	Less than 0.1.
T110	2–3	Less than 0.1.
	1–4	Less than 0.1.
T111	2–4	Less than 0.1.
T112	3–6	44.
	1–2	480.
T113	1–2	33.
	3–4	0.9.
T115	1–2	530.
	3–4	48.

c. AMPLIFIER.

Transformer or coil	Terminals	Ohms
L201		Less than 0.1.
L202		Less than 0.1.
L203		Less than 0.1.
L204		Less than 0.1.
L205		Less than 0.1.
RL201 coil		400.
T201	Secondary	Less than 0.1.
	Primary	6.

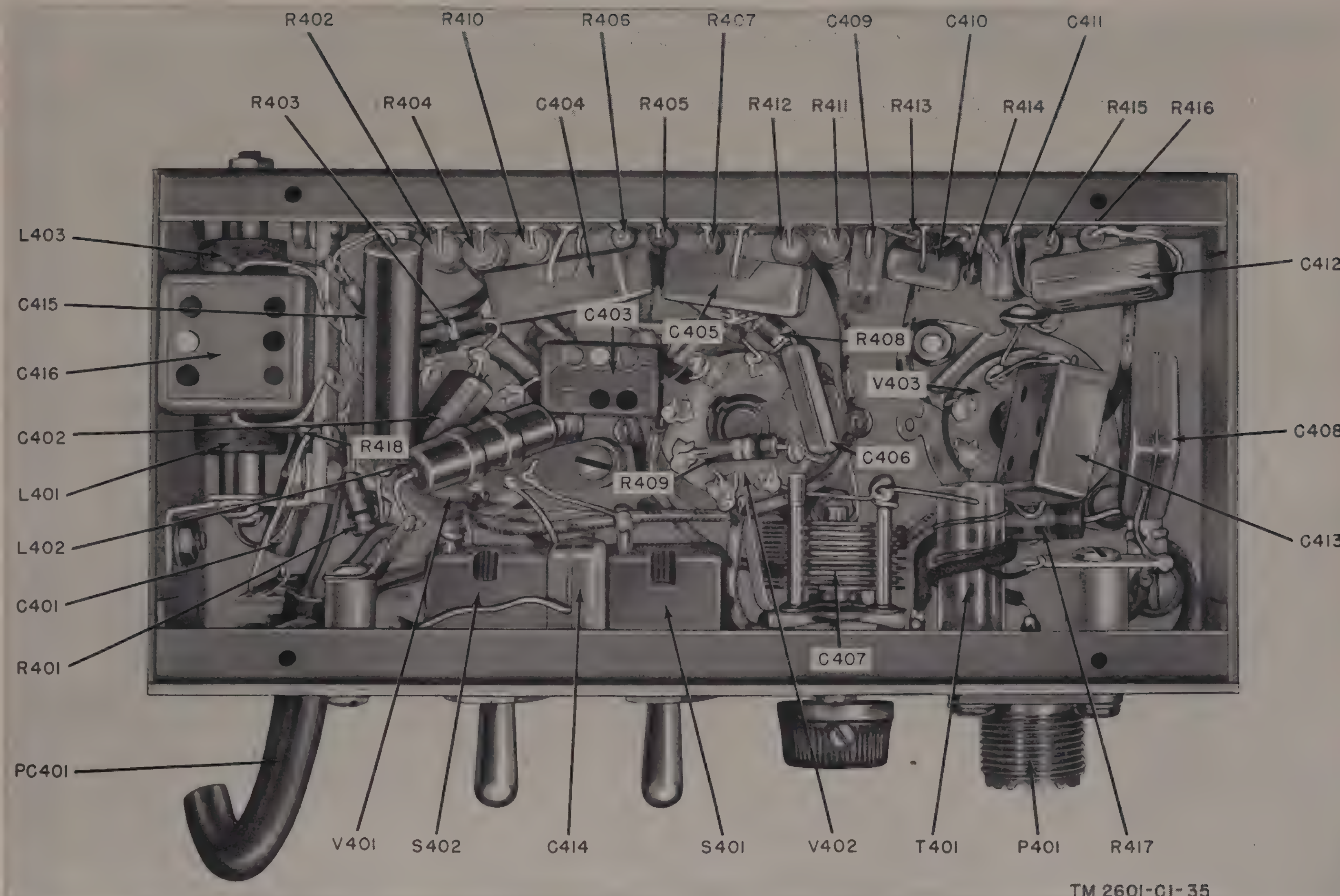

Figure 176. Test Oscillator TS–32C/TRC–1 chassis, bottom view.

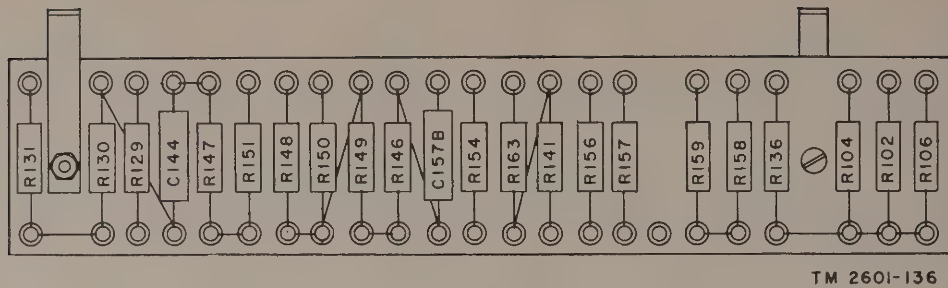

Figure 177. Radio Receiver R–19H/TRC–1, main component mounting board.

d. Power Supply.

Transformer or coil	Terminals	Ohms
CH301		250
CH302		80
T301	1–2	7
	3–4	.1
	5–6	150
	6–7	150
T302	Primary	.2
	½ secondary	300
	½ secondary	300
T303	Primary	2.5
	2.5 V secondary	.1

242. Signal Substitution Notes

a. Signal substitution requires sources of a-f and r-f signals. Audio Oscillator TS–382A/U and Signal Generator TS–497A/URR are suitable.

b. Electronic Multimeter TS–505/U is needed to check the input to the tested stage. Multimeter TS–352/U or Output Meter TS–585/U is used to measure the receiver output. If Multimeter TS–352/U is used, connect a 450-ohm, noninductive resistor in parallel with it and use the 5,000-ohm AC VOLTS ranges of the meter.

c. Tube Tester I–177 or TV–3/U is also required to isolate and check the suspected part after the faulty stage has been indicated by signal substitution.

d. Note the volume and listen for serious distortion from the loudspeaker at the various points in the signal substitution procedure. If possible, compare with a receiver known to be in good condition.

e. Check the wiring and soldering in each stage during the procedure.

f. Do not remove the shield can of a tuning unit until the trouble has been traced to that particular unit. Do not damage the wiring or detune r-f circuits by pushing wires back and forth during inspection. Be careful not to damage the receiver in any way.

g. Misalinement of one or more stages of the receiver will cause reduced output. Misalinement of the oscillator may prevent any output.

h. When trouble is localized to a given stage, first test the tube; then measure the voltages; finally measure the resistances at the tube socket of that stage *with the power off.*

i. Trouble in a circuit or stage may not cause changes in voltage and resistance measurements at the tube socket. The instructions included in this paragraph are merely a guide and should suggest other procedures, such as voltage and resistance measurements on individual parts.

j. Remove only one tube at a time when testing. Check the number of the tube, test the tube, and, if it is not defective, return it to its socket before another tube is removed.

k. For all of the tests, it is assumed that the power supply is operating properly. It is also assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble located before proceding with any succeeding steps. Refer to section II of this chapter for repair procedures.

243. Checking Receiver

a. Signal Tracing. Signal tracing may be used as a quick means of checking the continuity of a received signal through the receiver. However, by using the signal tracing analysis chart below, much more extensive measurements can be made. This chart lists the normal input voltages required at each of the r-f and i-f stages of the receiver to produce a signal of 3 volts at the first limiter grid when a signal of 2 microvolts is fed to the antenna input terminal of the receiver. It also lists the normal voltages

produced in the audio portions of the receiver when a .5 volt signal is fed to the first audio stage. Therefore it may serve as a standard when checking the over-all gain of the receiver, the gain of each stage, or the gain of a group of stages. By using the signal tracing analysis chart, the receiver can be checked as follows:

(1) Set the LINE switch to ON and the SQUELCH switch to OFF. Turn the SPEAKER VOLUME and the AUDIO GAIN controls to the maximum clockwise position (maximum volume and gain). Set the SPEAKER ON-OFF switch to ON.

(2) Connect one end of a 50-$\mu\mu f$ (micromicrofarad) capacitor to the receiver antenna terminal.

(3) Connect the signal generator output lead to the other end of the 50-$\mu\mu f$ capacitor, and connect the ground lead to the receiver chassis.

(4) Adjust the signal generator to supply an output signal voltage of the amplitude listed in the antenna column of the signal tracing analysis chart below for a specific frequency; tune the receiver and signal generator to that frequency.

(5) Using a VTVM, read the input voltage of each r-f and i-f stage in succession, beginning with the first r-f tube, V101.

(6) To check the audio circuits, connect one end of a .01-μf (microfarad) capacitor to the first a-f grid (pin 4 of V115) and the other lead to the audio-signal generator.

(7) Adjust the audio-signal generator frequency to 1000 cps and the output voltage to the value indicated in the chart below.

(8) Using a VTVM read the voltage at the points indicated by the chart.

(9) If a stage has an input signal voltage above or below the signal-voltage tolerance given in the chart, the preceding stage is not supplying normal gain.

Method of input	Input frequency	Signal generator output	Output measured at	VTVM readings
Antenna	98 mc	2 uv	1st r-f grid (pin 4 of V101)	2 uv
Antenna	98 mc	2 uv	2d r-f grid (pin 4 of V102)	20 uv
Antenna	98 mc	2 uv	1st mixer grid (pin 4 of V103)	320 uv
Antenna	98 mc	2 uv	1st i-f grid (pin 4 of V104)	660 uv
Antenna	98 mc	2 uv	Mixer grid (pin 4 of V105)	10 mv (millivolts)
Antenna	98 mc	2 uv	2d i-f grid (pin 4 of V106)	375 mv
Antenna	98 mc	2 uv	1st limiter grid (pin 4 of V107)	3 v
Grid (pin 4 of V115)	400 cps	0.5 V	Grid (pin 5) of V114	2.75 v
Grid (pin 4 of V115)	400 cps	0.5 V	Terminal 4 of T113	14 v
Grid (pin 4 of V115)	400 cps	0.5 V	Receiver output	14 v

b. Signal Substitution. In signal substitution a signal voltage of the correct frequency and amplitude is fed directly to the input of each i-f and r-f stage in order to maintain a reading of 3 volts at the first limiter grid. With this type of testing the chart below is used. The procedure is as follows:

(1) Set the LINE switch to ON and the SQUELCH switch to OFF. Turn the SPEAKER VOLUME and the AUDIO GAIN controls to the maximum clockwise position (maximum volume and gain). Set the SPEAKER ON-OFF switch to ON.

(2) Connect one lead of a VTVM to the grid of the first limiter (pin 4 of V107). Connect the other to the chassis of the receiver (ground).

(3) Using a signal generator with a measured output, feed a signal of the correct frequency for the stage, having a voltage given in the signal tracing analysis chart, to each stage in succession. Begin with the grid of the 1-f i-f tube (V106) and work forward to the receiver input.

(4) If an output of 3.0 volts cannot be obtained when a signal voltage given in

the chart is applied to the stage, that stage is defective.

(5) To check the audio circuits, feed a signal from the audio-signal generator, through a .01-μf capacitor, to the first a-f grid (pin 4 of V115). A loud clear signal should be heard if the audio circuits are functioning properly.

(6) If a weak signal or no signal is heard, feed the signal from the audio-signal generator to the output, then to the input of each of the audio stages, beginning with the last stage and continuing until the defective or inoperative stage is located.

Stage checked	Method of input	Input frequency	Signal generator output in microvolts	VTVM at 1st limiter grid (pin 4 of V107)	Gain of stage
Antenna	Antenna	98 mc	2	3v	1
1st r-f	Grid (pin 4 of V101)	98 mc	2	3v	10
2d r-f	Grid (pin 4 of V102)	98 mc	20	3v	16
1st mixer	Grid (pin 4 of V103)	98 mc	320	3v	2
H-f i-f	Grid (pin 4 of V104)	46.5 mc	560	3v	15
2d mixer	Grid (pin 4 of V105)	5 mc	10K	3v	37.5
L-f i-f	Grid (pin 4 of V106)	5 mc	375K	3v	8
1st audio					5.5
Speaker amplifier V114					4.1
High-fidelity audio					4.1

244. Checking Amplifier

a. PREPARATION. Prepare the amplifier as follows:

(1) If amplifier AM–8(*)/TRA–1 is inoperative or does not respond properly and the trouble cannot be isolated by using techniques described in paragraph 239, turn off the power. Remove the amplifier from carry Case CY–15(*)/TRA–1.

(2) Remove Power Supply PP–13/TRA–1 from carrying Case CY–16(*)/TRA–1.

(3) Check all wiring and components for mechanical rigidity.

(4) Check the antenna transfer relay contacts for pitting.

(5) Check AMPLIFIER FUSE F302.

b. TUBE CHECK.

(1) Check all tubes in Amplifier AM–8(*)/TRA–1.

(2) A subnormal value of amplifier grid current can be caused by either insufficient excitation or lowered emission in tubes V201 and V202. If a check of the 829B tube, V9, in the transmitter shows that the tube is normal, check the amplifier grid tuning with the plate voltage removed, and check the coupling to tube V9.

(3) If grid current remains low, replace either tube V201 or V202, or both, to locate the tube or tubes at fault.

(4) Slightly raise the ground jumper across the sockets of tube V201 or V202 (or both) to check the ground connections.

(5) Slightly raise the ground jumper across the sockets of tubes V201 and V202, to check the neutralization.

(6) The normal grid current meter reading associated with the amplifier is 14 to 22 ma.

(7) The normal plate current meter reading associated with the amplifier is 220 to 270 ma. The normal plate voltage meter reading associated with the amplifier is 1,900 volts.

(8) Low emission will be accompanied by a gradual reduction in off-resonance plate current. In general, tubes which give an off-resonance current (for two tubes) of 300 ma or more are in good condition.

(9) In making this test, tune rapidly through resonance, and do not allow the plate circuit to remain off resonance for more than a few seconds at a time. A normal condition will be indicated by a dull red plate temperature

in tubes V201 and V202. A bright red color throughout the entire plate area indicates dissipation in excess of the rated value.

c. TUBE VOLTAGES.

(1) Check tube voltages of tubes V201 and V202 in Amplifier AM–8(*)/TRA–1. Incorrect readings (figs. 165 and 166) may mean that there is a faulty component in the circuit.

(2) A voltmeter across the filaments of tubes V1 and V2 should read between 4.75 and 5.25 volts ac.

(3) Normal grid bias for tubes V201 and V202 is between —120 and —135 volts dc.

(4) Normal screen voltage for tubes V201 and V202 is between 340 and 380 volts dc (positive).

(5) Check the input voltage. The line voltage should be between 110 and 120 volts as measured on the panel meter of Radio Receiver R–19(*)/TRC–1.

(6) Check the plate voltages as follows:

(*a*) Tune: 900 to 1,000 volts dc.

(*b*) Operate: 1,800 to 2,000 volts dc.

(*c*) No excitation: 2,000 to 2,400 volts dc.

d. GRID JIGGLE. Grid jiggle can be described as a continued oscillation of the meter needle when the meter is in the grid current position (position 5 of transmitter meter). If such a condition is present, take the steps described below.

(1) Tighten all screws and nuts; tighten the grounding screws considerably more than normal.

(2) Position the bus wires on tubes V1 and V2 until satisfactory operation is obtained.

(3) Check the plates of grid tuning capacitor C201 for foreign particles.

(4) Check whether the polystyrene connection on R-F INPUT connector P201 is broken.

e. OSCILLATION. With the amplifier tuned at 100 mc and fully loaded, remove the r-f excitation. There should be no plate or grid current indicated on the meter. The maximum permissible plate current is 15 ma. If meter readings exceed this value, the amplifier is oscillating. Neutralization is achieved by pushing the ground jumper across the 4E27 tube sockets closer to ground. At very high frequencies, the position of wires has a tremendous effect on circuit operation.

Section II. REPAIRS

245. Cleaning

Gasoline will not be used as a cleaning fluid for any purpose. Solvent, dry-cleaning, Federal specification P–S–661a, is available, as a cleaning fluid, through established channels. Oil, fuel, Diesel, U. S. Army specification 2–102B, may be used for cleaning purposes when solvent (SD) is not at hand. Carbon tetrachloride will be used only on contact parts of electronic equipment.

246. Removing Transmitter Parts

a. REMOVAL OF TRANSMITTER FROM CASE. Loosen the two Dzus fasteners on either side of the transmitter. Grasp the handle and slide the transmitter out.

b. REMOVAL OF BOTTOM PLATE. To remove the transmitter bottom plate, turn the four Dzus fasteners one-fourth turn counterclockwise with a screw driver.

c. REMOVAL OF TOP COVER. The top cover may be removed by turning the two Dzus fasteners and shifting the cover. Push the cover to the left to release the hinges. The fan and motor are located on the cover.

d. REMOVAL OF TUBES. Remove tubes as follows:

(1) Two 5R4GY tubes, located at the right rear of the set are removed by loosening the snap clamps at the base of the tubes and lifting the tubes from their sockets.

(2) To remove the stubby glass tube (829B), remove the two Fahnestock clip connectors on the top of the tube and rock it gently. When replacing this tube, be sure that the thick prong goes into the proper hole.

(3) All other tubes are removed in the normal manner.

e. REMOVAL OF FAN BLADE SHIELD. The fan blade shield, located on the top cover, may be removed by loosening six screws from the underside of the top cover.

f. REMOVAL OF FUSES. Remove fuses as follows:

(1) *LINE and P.A. FUSES.* These fuses may be removed by hand. Turn one-quarter way to the left and withdraw fuse. The P.A. FUSE is not used in the H models.

(2) *H.V. FUSE.* This must be removed with a screw driver. Turn it three and a quarter times to the left and withdraw.

(3) *REL. FUSE.* Remove the holder by unscrewing it. Then withdraw the holder and fuse. This fuse is in the H models only.

g. REMOVAL OF PILOT LIGHTS. Unscrew top nut with a wrench and lift out. Remove the light bulbs for testing.

h. REMOVAL OF CRYSTAL. To remove the crystal, pull the cover off the crystal oven (fig. 170) by grasping the handle. Pull the crystal out of its socket by rocking it gently.

i. REMOVAL OF AIR FILTERS. The air filters are located within the runner assemblies on either side of the transmitter. They may be removed by pulling them out from the back.

j. REMOVAL OF METER. Remove the wiring connected to the back of the meter by unscrewing the three nuts and lugs from the back of the meter. Remove the three screw and bolt assemblies attaching the meter to the panel and lift the meter out.

247. Cleaning, Inspecting, and Lubricating Transmitter Chassis

a. CLEANING. Thorough cleaning of the transmitter is necessary to insure optimum performance and to prevent corrosion, rust, and dirt from damaging parts, causing arc-over or low-resistance leakage between h-v parts and ground. Remove loose dust and dirt with a brush or blower. Remove dirt or grease which adheres to the chassis or parts with a brush or cloth and solvent (SD). Remove shield covers from parts and clean with a small brush or pipe cleaner and solvent (SD). Clean tuning capacitor bearings with solvent (SD). If this is not available and there is no stenciling on the set, use alcohol for cleaning. If there is stenciling, use a solution of 50 percent alcohol and 50 percent xylol. The filters should be inspected and replaced (if not of the permanent type) when they appear dirty. Permanent (stainless steel wire) type cleaners should be cleaned and lightly oiled with a light oil.

b. INSPECTING. After the transmitter has been cleaned thoroughly, make a visual inspection of parts and wiring for rust, corrosion, loose connections, frayed or burned insulation, loose screws, and burned or charred resistors and coils. Make a thorough and careful inspection of tube sockets for broken contacts. The wave-band switches must be checked for loose or bent contacts or broken insulation, and terminal boards for broken lugs and signs of burning. Inspect all tuning-dial gears, set screws, and antenna-relay contacts. Inspect the fuses on the front panels, they protect against accidental shorts and overloads in the unit.

c. LUBRICATING.

(1) Lubricate the tuning capacitor gear drive assembly with Grease, instrument (GL). This is a light grease such as Army-issue machine-gun grease and is suitable for use at all temperatures at which this receiver is designed to operate.

(2) For other moving parts requiring an oil lubricant, use Oil, lubricating, preservative, special. This oil is similar to commercial high-grade, low-pour-test, oxidation-inhibited mineral oil and is suitable for use at all temperatures at which this receiver is designed to operate.

(3) For general information on lubrication, see TB SIG 69.

248. Removing Parts, Checking, and Lubricating Receiver

a. Remove the tubes by rocking them gently and withdrawing them from their sockets.

b. Remove the parts by loosening the screws and holding brackets.

c. See paragraphs 245 and 247 for cleaning, inspecting, and lubricating. Use procedures similar to those explained for the transmitter.

249. Test Instruments Required

The test instruments required for final checking of these equipments are listed in paragraph 226. In tests not requiring a calibrated r-f wattmeter, Indicator Subassembly MX–970/U and a 50-watt bulb may be used in place of R-F Wattmeter ME–11/U.

250. Moving Parts and Finish

In addition to making electrical tests, check the moving or rotating parts for smoothness of operation. Also check units for the condition of the finish.

a. Check each unit for cleanness inside and outside.

b. Rotate all tuning and volume controls. Operation across the arc of rotation should be smooth. There should be no appreciable backlash or slipping of controls.

c. Try all switches, both rotary and toggle. They should snap firmly into each contact position. The momentarily on PUSH FOR LINE CHECK switch, S105, should return, on release, to its original position.

d. Insert the plugs into the proper jacks. The plugs should seat firmly and make good contact.

e. Check the fuse holders to see that the fuses may be removed easily but will lock tightly when inserted.

f. Observe the condition of the finish and plating. Both paint and plating should be free from corrosion, blisters, flaking, bare or worn spots, or deep scratches.

g. Instructions for refinishing badly marred panels are given in TM 9–2851.

251. Transmitter Alinement

a. LINE ON-OFF SWITCH, RELAY, AND PILOT LIGHTS. Check S1, RL1, PL1, and PL2 as follows:

(1) Set the LINE ON-OFF switch to OFF.

(2) Insert the 99.6-mc crystal into the socket in the crystal oven.

(3) Connect the A-C LINE to a 110- to 120-volt a-c power source.

(4) Set the POWER HIGH-LOW switch to LOW.

(5) Set the CARRIER CONTROL switch to position 1.

(6) Set the LINE ON-OFF switch to ON. FILAMENT ON light PL2 should light.

(7) Set the CARRIER CONTROL switch to position 4.

(*a*) Relay RL1 must close immediately with a clicking sound.

(*b*) After one-half minute has elapsed, plate time-delay relay TD3 must close with a clicking sound and the PLATE ON (red) light PL1 must light.

b. ALINEMENT. Aline the set as shown below (also refer to paragraph 130).

(1) Set the POWER HIGH-LOW switch to LOW.

(2) Set tuning transformer indicator dials T1, T2, T3, T4, and T5 (top of set) to approximately 99.6 mc.

(3) Set the METER SWITCH in turn to the position listed in the chart below.

Meter switch position	Transformer	Transmitter meter needle deflection
1	T1	Maximum.
2	T2	Maximum.
3	T3	Maximum.
4	T4	Maximum.
5	T5	Maximum.
6	P. A. TUNING control	Minimum.

(4) Adjust the transformer adjustment shafts of T1 through T5 for maximum needle deflection of the transmitter meter.

(5) Set the METER SWITCH to position 6 and rotate the P. A. TUNING control for minimum deflection of the needle on the panel meter.

(*a*) Tuning capacitors must not be at the extreme counterclockwise position (minimum capacitance).

(*b*) The setting of the indicator dials of each tuned stage must be at 100 mc ± 2.

(6) Remove the 99.6-mc crystal and replace it with a 72.2-mc crystal (low end of the band).

(7) Set the tuning transformer indicator dials to 71.2 mc.

(8) Repeat the steps in (4) and (5) above.

(*a*) The tuning capacitors must not be at the maximum capacitance position.

(*b*) The setting of the indicator dials of each tuned stage must be at 71.2 mc ±2.

252. Transmitter Meter and Meter Switch

a. CHECKING METER INDICATIONS.

(1) Set the LINE ON-OFF switch to OFF.

(2) Connect the A-C LINE to a 110- to 120-volt a-c power source.

(3) Set the POWER HIGH-LOW switch to LOW.

(4) Set the LINE ON-OFF switch to ON.

(5) Rotate the METER SWITCH in turn to positions 1 through 6 and note whether the readings correspond to the chart below.

Meter switch positions	Transmitter meter indication
1	0.2 to 0.4.
2	0.2 to 0.7.
3	0.4 to 0.8.
4	1.3 to 3.0.
5	1.2 to 2.5.
6	0.2 to 0.5.

(6) If the transmitter meter indications are not within these (5) limits, repeat the alinement procedure described in paragraph 251*b*.

b. CALIBRATION CHECK ON METER SHUNT R35.

(1) Set the POWER HIGH-LOW switch to LOW.

(2) Set the CARRIER CONTROL switch to position 1.

(3) Connect transmitter ANTENNA receptacle P7 to RF Wattmeter ME–11/U according to instructions in NAVSHIPS 91,118.

(4) Remove the P. A. FUSE in the unlettered through E models. Unsolder the lead between the V9 cathode (pin 4) and R35 in the H model, leaving C38 connected to the cathode.

(5) Connect the 500-ma d-c range of Multimeter TS–352/U to the P. A. FUSE holder terminals (or the R35 and cathode leads).

(6) Set the METER SWITCH to position 6.

(7) Set the CARRIER CONTROL switch to position 4.

(8) Repeat the tuning procedure described in paragraph 251*b*.

(9) Set the POWER HIGH-LOW switch to HIGH.

(10) Rotate ANTENNA LOADING capacitor C41 slowly clockwise, while adjusting the P. A. TUNING control for minimum indication on the transmitter meter, until Multimeter TS–352/U indicates 150 ma. The transmitter meter M1 indication must be 150 ±5 ma.

253. Transmitter Power Output and Fusing

a. POWER OUTPUT. Repeat the procedures described in paragraph 252*b*, adjusting the controls until the milliammeter indicates 155 ma.

(1) The transmitter meter indication must be 155 ±5 ma.

(2) RF Wattmeter ME–11/U must indicate a minimum output of 37 watts.

b. FUSING. Check the fusing as follows:

(1) Set the transmitter POWER HIGH-LOW switch to LOW.

(2) Remove the LINE FUSE. The FILAMENT ON and PLATE ON pilot lamps should go off.

(3) Set the transmitter METER SWITCH in turn to position 1 through 6. There should be no indication on the transmitter meter.

(4) Replace the LINE FUSE.

(5) Turn the LINE ON-OFF switch to OFF.

(6) Remove the H. V. FUSE.

(7) Turn the LINE switch to ON. The FILAMENT ON and PLATE ON pilot lights should go on.

(8) Set the transmitter METER SWITCH in turn to positions 1 through 6.

(9) There must be no indication on the transmitter meter.

(10) Turn the LINE switch to OFF.

(11) Replace the H. V. FUSE.

(12) In the unlettered through E models, remove the P. A. FUSE.

(*a*) Turn the LINE ON-OFF switch to ON and the CARRIER CONTROL switch to position 4.

(*b*) Set the transmitter METER SWITCH in turn to positions 1 through 6.

(*c*) The meter indications must be as listed in the chart in paragraph 252*a*(5) for positions 1 through 4.

(*d*) There must be no meter indications when the METER SWITCH is at position 5 or 6.

(13) In the H model, remove the SEL. RECT. FUSE.

(*a*) Turn the LINE ON-OFF switch to ON.

(*b*) Relay RL1 should not operate when the handset switch is closed.

254. Checking Transmitter Crystal Oven

a. Operate the set for 15 minutes.

b. Set the LINE ON-OFF switch to OFF.

c. Remove the crystal unit from the oven. The crystal unit must be warm, and the metal disk of the crystal oven must be warm.

255. Transmitter Input Continuity Tests

a. Set the LINE ON-OFF switch to OFF.

b. Disconnect all wires from transmitter. Do not remove the control cable.

c. Connect the ohmmeter to the posts listed in the chart below. The ohmmeter indications must be the same as those listed.

Ohmmeter connections		Ohmmeter indications
From	To	
SH. post	Right REC. post	Open circuit.
SH. post	Left REC. post	Open circuit.
SH. post	Right TRSG. post	Open circuit.
SH. post	Left TRSG. post	Open circuit.
SH. post	Right TELEPHONE EE–8 post.	Open circuit.
SH. post	Left TELEPHONE EE–8 post.	Open circuit.
SH. post	Chassis frame	Closed circuit.
Right REC. post	Left REC. post	50 ohms.
Right TRSG. post	Left TRSG. post	50 ohms.
Right TELEPHONE EE–8 post.	Right TRSG. post	25 ohms.
Right TELEPHONE EE–8 post.	Left TRSG. post	25 ohms.
Left TELEPHONE EE–8 post.	Right REC. post	25 ohms.
Left TELEPHONE EE–8 post.	Left REC. post	25 ohms.
Chassis	ANTENNA receptacle	Open circuit.
Chassis	RECEIVER receptacle.	Open circuit.

256. Checking Carrier Control Modulation Levels

a. WITH AUDIO OSCILLATOR.

(1) Plug the output of Audio Oscillator TS–382A/U (or equal) into the transmitter MICROPHONE jack (Use an adapter made up from three-contact plug PL–68 with the oscillator connections to the sleeve and ring.), or connect directly across the primary (terms 1 and 2) of transformer T10.

(2) Connect jumpers from the REC to the TRSG terminals on the transmitter panel (fig. 77).

(3) Connect the audio oscillator to an a-c source and turn on.

(4) Turn the receiver LINE ON-OFF switch ON.

(5) Turn the transmitter LINE ON-OFF switch to ON, the POWER HIGH-LOW switch to LOW, and the PLATE on switch to ON.

(6) Set the CARRIER CONTROL to position 4.

(7) Adjust the audio oscillator to 1,000 cps, and set the receiver METER SWITCH to position 6.

(8) Adjust the audio oscillator gain control until —4 db is indicated on the receiver meter.

(9) Set the transmitter CARRIER CONTROL switch to position 3. The receiver meter indication should be —4. db. (In the H model, the meter indication should be +4 db ±1.)

(10) Set the CARRIER CONTROL switch

to position 2. The receiver meter indication must be +4 db ±1.

(11) Disconnect the audio oscillator.

b. WITH MICROPHONE.

(1) Plug a handset into the MICROPHONE and HEADSET jacks.

(2) Set the CARRIER CONTROL switch to position 1.

(*a*) The PLATE ON pilot lamp must go off.

(*b*) The carrier-operated relay must go off with a click.

(3) Set the receiver SQUELCH ON-OFF switch to OFF. A rushing sound should be heard on the handset.

(4) Push the press-to-talk switch on the handset. The PLATE ON pilot lamp should light.

(5) Whistle a sustained note into the microphone. The receiver meter should indicate 6 db.

(6) Talk into the microphone at a moderate voice level. The receiver meter should indicate a 0-db average.

(7) Set the CARRIER CONTROL switch to position 2.

(8) Release the handset press-to-talk switch. The PLATE ON pilot lamp must light.

(9) Set the receiver LINE ON-OFF switch to OFF. The transmitter PLATE ON pilot lamp should go off.

(10) Set the receiver SQUELCH ON-OFF switch to ON and set the receiver LINE ON-OFF switch to ON. The transmitter PLATE ON pilot should remain off.

(11) Repeat the steps in *b* (4) through *b* (6) above.

(12) Set the receiver SQUELCH ON-OFF switch to OFF.

(13) Set the CARRIER CONTROL switch to position 3. The PLATE ON pilot lamp should go on.

(14) Set the receiver LINE ON-OFF switch to OFF. The PLATE ON pilot lamp should go off.

(15) Set the receiver SQUELCH switch and the receiver LINE ON-OFF switch to ON. The PLATE ON pilot lamp must remain off in the unlettered through E models. The PLATE ON lamp should go on in the H model.

(16) Push the handset press-to-talk switch. The PLATE ON pilot lamp must go on in the unlettered through E models.

(17) Whistle a sustained note into the microphone. The receiver meter should indicate approximately 0 db.

(18) Talk into the microphone at a moderate voice level. The receiver meter indication must be —8 db.

(19) Release the press-to-talk switch and set the CARRIER CONTROL switch to position 4. The PLATE ON pilot lamp should go on.

(20) Repeat the steps in (18) and (19) above.

257. Setting Modulation Controls

a. The AUDIO GAIN control of the receiver is preset at the factory for 30 percent modulation of the transmitter input for each v-f channel that is used. If there is a possibility that the factory adjustment of AUDIO GAIN control R143 has been maladjusted, it is necessary to procure a deviation standard, such as an f-m signal generator with a calibrated deviation scale, and a deviation meter or a similar standard.

Note. A spectrum analyzer may be used to check deviation by noting the disappearances of the center frequency as the audio input to the transmitter is increased.

b. In using the above standards to reset D143 to the correct adjustment, connect the output of the f-m signal generator (adjusted for 9-kc deviation at 1,000 cps modulation) to the ANT. INPUT terminals of the receiver.

c. Set the output of the signal generator to 50 uv or more.

d. Terminate the RECEIVER OUTPUT terminals with a 500-ohm resistor.

e. Adjust AUDIO GAIN control R143 so that the receiver panel meter will read 0 db ±1 db, with the receiver METER SWITCH in position 6.

f. Connect the leads of the audio oscillator across the transmitter TRSG. terminals.

g. Connect an output meter across the TRSG. terminals of the transmitter. Set the im-

pedance of the output meter to maximum (20,-000 ohms when using Output Meter TS–585/U) and the meter multiplier scale at —10 db.

h. Connect the transmitter to a 110- to 120-volt a-c power source. The FILAMENT ON pilot lamp should light.

i. Set the transmitter CARRIER CONTROL switch to position 4. The PLATE ON pilot light should go on. Aline Radio Receiver R–19(*)/TRC–1 to the r-f frequency of Radio Transmitter T–14(*)/TRC–1.

j. Set the receiver METER SWITCH to position 2. The receiver meter indication must be not less than 60.

k. Set the receiver METER SWITCH to position 4 and then 5. The receiver meter indication must be 0 ua for both METER SWITCH positions.

l. Set the receiver channel switch to MULTICHANNEL.

m. Turn the receiver SPEAKER ON-OFF switch to ON.

n. Rotate the receiver SPEAKER VOLUME control to the desired audio level.

o. Set the CABLE COMPENSATOR control to 0.

p. Adjust the audio oscillator for a 1,000-cps output.

q. Adjust the audio oscillator gain control for a +10-db indication on the output meter. (With the multiplier set at —10 db, this will result in a 0-db input to the transmitter.)

r. Set the receiver METER SWITCH to position 6. The receiver meter should indicate 0 db ±1.

(1) Zero db is the reference level based on 1 mw across 500 ohms.

(2) For an output meter with a 0-db reference level based on 6 mw across 600 ohms, the 0-db point required above will be —8 db on the output meter.

s. If the receiver meter does not indicate 0 db ±1, transmitter modulation control R44 (the potentiometer which is accessible on the chassis below the top cover of the transmitter) may be rotated from the extreme counterclockwise position until the receiver meter indicates 0 db with the receiver METER SWITCH at position 6. After this adjustment, put glyptal on the potentiometer shaft to prevent a change in position.

Caution: Do not disturb potentiometer R165 which on some models is located underneath the chassis of the transmitter. This potentiometer is a shunt adjustment for the front panel meter when the METER SWITCH is in position 6.

t. In the H model, METER SWITCH position 7 on the transmitter will give an indication of modulation level. When adjusting this model, it is not necessary to have a factory-adjusted receiver or a means for checking receiver modulation. Instead, proceed as follows:

(1) Connect the leads of the audio oscillator across the transmitter TRSG. terminals.

(2) Connect the output meter across the TRSG. terminals of the transmitter. Set the impedance of the output meter to a maximum (20,000 ohms when using Output Meter TS–585/U and the meter multiplier scale at —10 db.

(3) Connect the transmitter to 110- to 120-volt a-c power source. Throw the LINE ON-OFF switch to the ON position. The FILAMENT ON pilot lamp should light.

(4) Set the CARRIER CONTROL switch to position 4. The PLATE ON pilot lamp should light.

(5) Adjust the audio oscillator for a 1,000-cps output.

(6) Set the CABLE COMPENSATOR control on the transmitter to 0.

(7) Adjust the audio oscillator gain control for a +10-db indication on the output meter ((2) above). With the multiplier on Output Meter TS–585/U set at —10 db, this will result in a 0-db input to the transmitter. A 0-db input to the transmitter corresponds to 1 mw into 600 ohms.

(8) The meter on the front panel of the transmitter, with the METER SWITCH in position 7, must read 1 ma.

(9) If the meter does not read 1 ma, transmitter modulation control R44 (the potentiometer which is accessible on the chassis below the top cover of the transmitter) may be rotated from the extreme counterclockwise position until the meter reads 1 ma. After this adjustment, put glyptal on the potentiometer shaft to prevent any further change in position.

Caution: Do not disturb potentiometer R165 which is located under the chassis of the receiver. This potentiometer is a shunt adjustment for the front panel meter when the METER SWITCH is located in position 6.

258. Transmitter Over-all Audio Response Check

Set the audio oscillator in turn to 250, 1,000, 5,000, and 12,000 cps. For each frequency, adjust the audio oscillator gain control for a —8-db indication on the output meter. Indications on the receiver panel meter must fall within the limits stated in the chart below.

Frequencies (cps)	Receiver meter indications (db)
250	−2 to 0.
1,000	0 (reference level).
5,000	−1 to +2.
12,000	−1 to +2.

259. Transmitter Audio Distortion Check

a. Connect the oscilloscope to the transmitter REC. terminal or the receiver RECEIVER OUTPUT terminal.

b. Set the audio oscillator to 1,000 cps.

c. Adjust the oscilloscope to obtain a pure sine wave pattern on the screen.

d. Adjust the audio oscillator in turn to 250, 5,000, and 12,000 cps.

e. Focus the pattern on the screen at each frequency. There should be no distortion of the oscilloscope pattern at any frequency.

260. Level Linearity and Cable Compensator Check

a. Set the audio oscillator to 1,000 cps.

b. Adjust the oscillator gain control to obtain a —8-db indication on the receiver meter.

c. Rotate the CABLE COMPENSATOR control in turn from position 1 through 12.

(1) The receiver meter indication must increase 1 db as the switch is rotated to each position.

(2) At position 12 of the CABLE COMPENSATOR control, the receiver meter should indicate 4 db ±1.

261. Checking Filter in Local Microphone Circuit

a. Turn off the oscilloscope.

b. Disconnect the oscillator and the output meter leads from the TRSG. terminals.

c. Insert oscillator plug into the MICROphone jack. (Use an adapter made up from three-contact plug PL–68 with the oscillator connections to the sleeve and ring.)

d. Set the CABLE COMPENSATOR to 0.

e. Set the receiver METER SWITCH to position 6.

f. Set the audio oscillator to a frequency of 1,000 cps.

g. Adjust the gain control of the audio oscillator until the receiver meter indicates 0 db.

h. Increase the af gradually to 3,500 cps, observing the receiver panel meter.

(1) Between 1,000 and 2,500 cps, the receiver meter indication must fall below —.5 db.

(2) Between 2,500 and 2,800 cps, the receiver indication must decrease.

(3) At 2,800 cps, the receiver meter indication must be below —5.0 db.

(4) The frequency indication must be not more than 3,200 cps when the receiver meter indication is 2ua or one division to the right of 0 (approximately —30-db attenuation).

262. Transmitter Tapping Test

a. Connect an oscilloscope to the transmitter REC. terminal or the receiver RECEIVER OUTPUT terminal.

b. Set the CABLE COMPENSATOR switch to position 1.

c. Adjust the audio oscillator output at 1,000 cps for a —8-db reading on the output meter. Check that receiver is tuned to transmitter frequency.

d. Adjust the oscilloscope to obtain a sine wave pattern on the screen.

e. Tap the r-f transformer shields, the tubes, and the inner side of the transmitter housing.

(1) There must be no distortion of waveform on the oscilloscope screen.

(2) There must be no interruption, noise, or breaking up of sound from the receiver speaker due to tapping.

f. Turn off audio oscillator.

263. Receiver Switch and Control Tests

a. LINE ON-OFF SWITCH. Check switch S103 as follows:

(1) Connect the A-C LINE cord to a 115-volt, 50- to 60-cycle power source.

(2) Set the LINE ON-OFF switch to ON.

(*a*) The POWER ON pilot lamp (green) on the panel should light.

(*b*) The filament of the tubes in the chassis must light.

(3) Set the LINE ON-OFF switch to OFF.

(*a*) The POWER ON pilot lamp (green) must go out.

(*b*) The filament must go out.

(4) Set the LINE ON-OFF switch to ON.

b. A-C LINE VOLTAGE TEST. Check switch S105 and line voltage as follows:

(1) Set the METER SWITCH to position 6.

(2) Depress and hold down the PUSH FOR LINE CHECK switch. The meter needle should stop at the red line (115 volts ±5 percent of full scale).

(3) Release the PUSH FOR LINE CHECK switch. The meter indication should be 0.

c. SPEAKER ON-OFF SWITCH AND SPEAKER VOLUME CONTROL. Check as follows:

(1) With the SQUELCH ON-OFF switch in the OFF position, set the SPEAKER ON-OFF switch to ON. Noise should be heard in the speaker.

(2) Set the SPEAKER ON-OFF switch to OFF. There should be no noise heard in the speaker.

(3) Set the SPEAKER switch to ON.

(4) Slowly rotate the SPEAKER VOLUME control fully clockwise; the noise volume should gradually increase to maximum. Rotate the control fully counterclockwise; the noise should gradually decrease.

d. AUDIO GAIN CONTROL. Check as follows:

(1) Set the METER SWITCH to position 6.

(2) Turn on audio oscillator and adjust to 1000 cps.

(3) Note the exact meter reading.

(4) Rotate the AUDIO GAIN control fully clockwise and then counterclockwise.

(5) The meter needle should deflect smoothly and evenly over the full scale in the direction of rotation of the control.

(6) Return the AUDIO GAIN control to the position that gives the reading noted in (3) above.

e. MULTICHANNEL SINGLE CHANNEL FILTER SWITCH AND FILTER. Check as follows:

(1) Set the filter switch to MULTICHANNEL.

(2) Set the METER SWITCH to position 6.

(3) Rotate the AUDIO GAIN control until 0 indication appears on the db scale of the meter.

(4) Set the filter switch to SINGLE CHANNEL. The indication on the db scale must be between —8 and —10.

(5) Return the AUDIO GAIN control to its original setting.

f. SQUELCH ON-OFF SWITCH. Check as follows:

(1) Set the SQUELCH ON-OFF switch to OFF. The CARRIER ON lamp (red) must light.

(2) Set the SQUELCH ON-OFF switch to ON. THE CARRIER ON pilot lamp must go out. On some unlettered models, this may not happen unless the SQUELCH ADJUST control is rotated.

264. Test Oscillator Socket Check

a. Connect the d-c voltmeter between the chassis frame and pin 4 of the TEST OSC socket. (Socket pin numbers are located by counting counterclockwise from the guide.) Plate voltage indication should be 220 volts ±10.

b. Connect the a-c voltmeter between the chassis frame and pin 7 of the TEST OSC socket. Filament voltage indication should be 6 volts ± .6.

c. Turn the receiver LINE ON-OFF switch to OFF. Connect the ohmmeter between the chassis frame and pin 4 of the TEST OSC socket. The resistance indication should be at least 22,000 ohms.

265. Receiver Alinement and Sensitivity Checks

a. Connect the signal generator to the receiver ANT. INPUT socket.

b. Turn the receiver LINE ON-OFF switch to ON and set the receiver METER SWITCH to position 1.

c. Set the signal generator as follows:

(1) The modulation frequency to 1,000 cycles.

(2) The frequency of the signal generator to that marked on the crystal used in the receiver.

d. Adjust the signal generator voltage output until 1.0 is indicated on the receiver meter.

e. Set the receiver SPEAKER ON-OFF switch to ON.

f. Rotate the receiver SPEAKER VOLUME control clockwise until a signal is heard.

g. If no signal is heard, adjust the frequency control dial of the signal generator until the signal is heard.

h. Set the receiver METER SWITCH to position 4.

i. Rotate the signal generator frequency dial until the receiver meter needle returns to 0.

j. Set the receiver METER SWITCH to position 1.

k. Rotate T110, the transformer adjustment (on top of the receiver chassis), until maximum deflection is indicated on the receiver meter.

l. Set the METER SWITCH to position 4.

m. Adjust the signal generator frequency dial until 0 is indicated on the receiver meter.

n. Repeat the steps indicated in *k* through *m* above on each of the following controls in the order given.

(1) T111.

(2) T105.

(3) T104.

(4) T103.

(5) T102.

(6) ANTENNA TUNING.

o. Adjust the signal generator voltage output to 5 uv.

p. Set the receiver METER SWITCH in turn to each of the positions listed in the chart below. The meter indications should be the same as those shown opposite the METER SWITCH positions in the chart.

Meter switch positions	Panel meter indications
1	50 to 100.
2	One-half of actual indication obtained at meter position 1 ±10%.
3	30 to 60.
4	0.
5	0.

266. Receiver Output Terminal Check

a. With the receiver in normal operation, connect the power output meter leads to the RECEIVER OUTPUT terminals. When a signal from the signal generator, set at the receiver crystal frequency, is fed into the receiver ANT. INPUT socket, the meter needle (with the METER SWITCH on position 1 or 2) should deflect.

b. Connect the leads from the oscilloscope to the RECEIVER OUTPUT terminals. A waveform should appear on the oscilloscope, corresponding to the signal generator modulation waveform.

267. Signal-plus-noise to Noise Ratio

a. Set the signal generator voltage output to 5 uv.

b. Set the signal generator modulation to 1,000 cycles, 30 percent. Note the db indication on the power output meter for use in the step indicated in *d* below.

c. Turn off the signal generator modulation. Again note the db indication on the power output meter for use in the step indicated in *d* below.

d. The difference between the two power output meter indications in the steps described in *b* and *c* above is the signal-plus-noise to noise ratio. This ratio should not be less than 25 db.

268. Squelch Sensitivity and Adjustment

a. Set the signal generator r-f output to zero.

b. Set the SQUELCH ON-OFF swtch to ON.

c. Rotate the SQUELCH ADJUST control gradually counterclockwise from the extreme clockwise position until a rushing noise in the receiver speaker is completely quieted. The CARRIER ON pilot lamp (red) should go out.

d. Gradually increase the r-f output of the signal generator until the squelch relay operates.

(1) The CARRIER ON pilot lamp (red) should light.

(2) A slight rushing noise should again be heard in the receiver speaker.

(3) The signal generator voltage output should then be not more than 2 uv.

e. Rotate the SQUELCH ADJUST control to the extreme clockwise position.

(1) The receiver rushing noise should be quieted.

(2) The CARRIER ON pilot lamp (red) should go out.

f. Increase the signal generator r-f output until the squelch relay releases.

(1) The CARRIER ON pilot lamp (red) should light.

(2) The signal generator output will be 1 mv or more.

269. Quieting

a. Connect a 500-ohm resistor across the RECEIVER OUTPUT terminals.

b. Rotate the receiver AUDIO GAIN control fully clockwise.

c. Set the receiver SQUELCH ON-OFF switch to OFF.

d. Set the receiver switch to MULTICHANNEL.

e. Set the signal generator output to 2 uv with no modulation. Note the db indication on the power output meter.

f. Reduce the signal generator voltage to 0. Note the db indication on the power output meter.

g. The difference in readings between the steps described in *e* and *f* above should be at least 20 db. This difference indicates the noise ratio between an unmodulated signal and a no-signal input to the receiver.

270. Receiver Audio Output Levels

a. Connect the output meter to the RECEIVER OUTPUT terminals.

b. Connect the signal generator to the receiver ANT. INPUT socket.

c. Turn the signal generator to the same frequency as the receiver.

d. Adjust the signal generator output to 5 mv, 1,000 cps with the modulation at 30 percent.

e. Adjust the output meter impedance to 500 ohms. (Shunt a suitable resistor across the RECEIVER OUTPUT terminals, if necessary. Take into account the output meter resistance on the scales covering +18 and +20 db.)

f. Set the AUDIO GAIN control to maximum. The output meter indication should not be less than 18 db.

g. Connect the output meter between pin E on the control cable socket and ground.

h. Set the output meter impedance to 1,000 ohms.

i. Set the SPEAKER ON-OFF switch to ON.

j. Turn the SPEAKER VOLUME control to maximum. The output meter indication must be not less than 0 db.

271. Receiver Over-all Audio Response

a. ARRANGEMENT OF EQUIPMENT.

(1) Connect a 500-ohm resistor across the TRSG. terminals of the transmitter. (The jumpers interconnecting the TRSG. and REC. terminals should be removed.)

(2) Connect the audio oscillator across the transmitter TRSG. terminals in series with a 2,000-ohm resistor.

(3) Connect a 500-ohm resistor across the RECEIVER OUTPUT terminals.

(4) Connect the output meter across the transmitter TRSG. terminals.

(5) Connect the oscilloscope across the RECEIVER OUTPUT terminals.

(6) Aline the transmitter to the same frequency as the receiver under test.

(7) Operate the transmitter, unloaded, on low power.

b. PROCEDURE.

(1) Turn the transmitter CABLE COMPENSATOR control to 0.

(2) Set the transmitting CARRIER CONTROL switch to position 4.

(3) Set the receiver filter switch to MULTICHANNEL.

(4) Tune the receiver under test to the same frequency as the transmitter.

(5) Set the receiver SPEAKER ON-OFF switch to ON.

(6) Turn the receiver SPEAKER VOLUME control until moderate volume is obtained on the receiver speaker.

(7) Set the receiver METER SWITCH to position 2. The receiver meter indication must not be less than 60.

(8) Set the receiver METER SWITCH to positions 4 and 5 in turn. The receiver discriminator must be balanced, indicated by a 0 reading on the receiver meter.

(9) Set the METER SWITCH to position 6.

(10) Tune the audio oscillator to 1,000 cycles.

(11) Adjust the oscilloscope to obtain a clear sine-wave pattern on the screen.

(12) Adjust the audio oscillator gain control to obtain —8 db on the output meter. The receiver meter indication must be 0 db.

Note. Zero db for the output meter is a reference level based on 6mw across 600 ohms. Zero db for the receiver meter is a reference level based on 1mw across 500 ohms. Zero db indication on the receiver meter corresponds to —8 db on the output meter.

(13) Tune the audio oscillator to 250 cycles.

(14) Adjust the audio oscillator gain control to obtain —8 db on the output meter.

(*a*) The receiver meter should indicate between —2 db and 0 db.

(*b*) The oscilloscope pattern must not show any appreciable distortion.

(15) Tune the audio oscillator to 5,000 cps.

(16) Adjust the audio oscillator gain control to obtain —8 db on the output meter.

(*a*) The receiver meter indication must not be more than ±1 db.

(*b*) The oscilloscope pattern must not show any appreciable distortion.

(17) Repeat (16) above with an audio frequency of 12,000 cps.

272. Receiver Audio Filter Operation

a. Place filter switch S104 in the SINGLE CHANNEL position.

b. Perform the over-all audio response test (par. 271).

c. Gradually increase the audio oscillator frequency from 1,000 cps, at the same time adjusting the audio oscillator output to give a —8 db output meter indication. Continue these adjustments until the receiver meter indication decreases abruptly.

(1) The receiver meter must indicate not more than 1 division above 0 on the panel meter microampere scale (equivalent to a 30-db decrease in output).

(2) The audio oscillator frequency setting must not be more than 3,200 cps.

(3) The oscilloscope pattern must be a straight horizontal line.

273. Receiver Level Linearity

a. Arrange the equipment as described in paragraph 271.

b. Tune the audio oscillator to 1,000 cps.

c. Set the receiver METER SWITCH to position 6.

d. Adjust the audio-oscillator gain control to obtain a —8 db indication on the receiver meter. Note the receiver meter indication for use in the step described in *e* below.

e. Rotate the transmitter CABLE COMPENSATOR control one step at a time from positions 1 to 12.

(1) The receiver meter indication must increase 1 db for each change in the transmitter CABLE COMPENSATOR control setting.

(2) The final receiver meter indication must be 4 db ± ½.

274. Receiver Bandwidth Test

a. Disconnect the signal generator from the receiver ANT. INPUT.

b. Insert the hot signal generator lead prod into pin 4 of socket V105 (second mixer tube).

c. Clip the signal generator ground lead to the chassis frame.

d. Set the receiver METER SWITCH to position 4.

e. Tune the signal generator to 5 mc. The receiver meter should indicate 0 ma.

f. Set the RECEIVER SWITCH to position 5. The receiver meter should indicate 0 ua.

g. Set the receiver METER SWITCH to position 1.

h. Adjust the signal generator r-f voltage control dial until the receiver meter indicates 60 ua.

i. Set the signal generator output to twice the voltage indicated on the signal output meter.

j. Adjust the signal generator frequency dial until the receiver meter again indicates 60 ua. Note the signal generator frequency dial indication for use in the step in *l* below.

k. Turn the signal generator frequency dial in the opposite direction until the receiver meter needle deflects and then returns to 60. Note the signal generator frequency dial indication for use in the step in *l* below.

l. Obtain the difference between the indications noted in the steps described in *j* and *k* above and multiply the result by 2. This is the bandwidth in kc. Bandwidth must be 80 kc minimum.

275. Checking Test Oscillator TS–32(*)/TRC–1

a. Arrange Radio Receiver R–19(*)/TRC–1 for operation at 70 mc. Use a receiver crystal for this frequency.

b. Connect the plug of test oscillator cable PC401 to the receiver TEST OSC socket.

c. Connect the coaxial cable from the oscillator R-F OUTPUT socket to the receiver ANT. INPUT.

d. Insert a 70-mc transmitting crystal in the oscillator crystal socket.

e. Set the oscillator CARRIER and MODULATION switches to ON.

f. Set the receiver METER SWITCH to position 1.

g. Adjust the oscillator TUNING control until the receiver meter indicates maximum.

h. If the meter needle goes off scale, set the receiver METER switch at position 2.

i. Continue adjusting the oscillator TUNING control until the receiver meter indication is maximum. A distinct tone should be heard in the receiver speaker.

j. Repeat the test with the receiver and oscillator tuned to 100 mc, using 100-mc receiving and transmitting crystals.

276. Amplifier Alinement and Power Output Test

a. ALINEMENT. Aline Amplifier AM–8(*)/TRA–1 in accordance with a paragraph 132; then—

(1) Check the grid current, without plate voltage applied to the amplifier, by placing the METER SWITCH in the GRID CURRENT position. The reading on meter M201 should be approximately 22 ma.

(2) Set the METER SWITCH at the PLATE CURRENT position.

(3) Throw the OPERATE-TUNE switch to OPERATE and the PLATE ON-OFF switch to ON.

(4) Adjust the PLATE TUNING control for a minimum reading.

(5) Adjust the ANTENNA LOADING for a maximum reading. Readjust the PLATE TUNING for a minimum reading.

(6) The plate current reading of meter M201 should be 270 ma.

b. POWER OUTPUT TEST.

(1) Throw the PLATE ON-OFF switch to OFF.

(2) Connect an r-f wattmeter, Bird Corporation Model 67 or equal, to the ANTENNA receptacle of Amplifier AM–8(*)/TRA–1.

(3) Throw the PLATE ON-OFF switch to ON. The r-f wattmeter should indicate approximately 250 watts.

277. Amplifier Linearity and Distortion Checks

a. LINEARITY CHECK. Proceed as follows:

(1) Connect the amplifier to the transmitter.

(2) Connect the VTVM to the receiver output terminals.

(3) Connect an audio oscillator to the microphone jack of the transmitter.

(4) Turn the audio oscillator on and, with the transmitter, amplifier and receiver operating on the same frequency, check the reading on the VTVM. Vary the audio gain and the audio-oscillator output for convenient reading.

(5) Vary the audio frequency from 250 cps to 20,000 cps. Keep the audio output constant and check the VTVM reading. The change should not be any more than 1 percent over the audio range checked.

b. DISTORTION CHECK. To check that the amplifier is not introducing distortion on the audio signal, proceed as follows:

(1) Set up the transmitter and the receiver for operation.

(2) Connect the receiver output directly to the vertical plates of a cathode-ray oscilloscope.

(3) Watch the resultant waveforms on the oscilloscope as the audio oscillator is varied from 250 cps to 20,000 cps.

(4) Connect the amplifier to the transmitter. There should not be a change in the cathode-ray pictures for each frequency checked when the amplifier is added to the circuit.

c. HUM AND NOISE LEVEL. Proceed as follows:

(1) Feed an audio note through the transmitter to the receiver and listen to the sound.

(2) Connect a fully loaded amplifier to the transmitter and listen to the note in the receiver. There should be no additional noise.

278. Power Output Stability

a. PREPARATION. Set up an induction type line-voltage regulator so that the line voltage can be varied from 105 to 115 volts ac.

b. PROCEDURE.

(1) Set the line voltage to 105 volts. Check the power output as indicated in paragraph 276*b*.

(2) Vary the line voltage to 115 volts ac; note the power output.

(3) The change in the power output between the steps described in (1) and (2) above should not be over 15 percent.

279. Amplifier Interlock, Relay, and Thermostat Operation

a. INTERLOCK OPERATION. Proceed as follows:

(1) Set the meter to read PLATE VOLTAGE.

(2) With the amplifier fully loaded, open and close the cover several times. Watch the voltmeter. When the cover is open, a zero reading should result; when the cover is closed, the reading should be normal.

b. RELAY OPERATION. The antenna transfer relay is activated when sufficient screen current passes through its coil to magnetize the lever arm. This relay may be tested as follows:

(1) Tune the amplifier plate circuit. The relay should close when the resonant point is reached.

(2) Lift the amplifier cover; then use a board to open and close the interlock switch. The relay operation should follow the interlock operation.

Caution: Make sure that the board used is thoroughly dry. Do not, under any circumstances, place fingers or hands inside amplifier cover.

c. THERMOSTAT OPERATION.

(1) Warm up a soldering iron and apply heat to thermostat TD201. The thermostat should close and the fan should go on.

(2) Spray the thermostat with ethyl chloride to cool the unit. The thermostat should open and the fan should go off.

280. Amplifier Calibration and Operational Checks

a. CALIBRATION.

(1) With the TUNE-OPERATE switch on TUNE, set capacitor C201 so that it is unmeshed.

(2) Set the grid dial to 100.

(3) Adjust grid coil L202 to resonate at 100 mc. Check the plate and grid tuning as outlined in paragraphs 132 and 276.

(4) Set the TUNE-OPERATE switch on OPERATE. Adjust grid coupling coil L201 to transfer enough energy to the meter so that it will read at least 22 ma of grid current at no load.

(5) Recheck the calibration.

(6) Fully load the amplifier.

b. OPERATIONAL TEST. Allow the amplifier to run for 1 hour fully loaded at 100 mc.

(1) Tune the plate circuit. Check that the bottom of the resonant curve reads 270 ma. Then go off resonance. The

meter reading should rise up to 350 ma. If the plate current rises from 300 to 350 ma and suddenly dips back to 280 or 290 ma, it signifies a double resonance dip. Correct this as follows:

(*a*) Tighten the coupling.

(*b*) Change the tubes.

(*c*) Retune the grid current.

(*d*) Push first one than the other neutralizing wires close to ground.

(2) Check to see whether the plate and grid tuning dials at resonance read between 98 and 102 mc.

(3) Check the meter readings against the following figures:

(*a*) The grid current should be greater than 11 ma.

(*b*) The plate current should be at 270 ma.

(*c*) The plate voltage in the TUNE position of S204 should be 900 to 1,000 volts.

(*d*) The plate voltage in the OPERATE position of S204 should be 1,800 to 2,000 volts.

(4) Check the power output as described in paragraph 276*b*. Measure the power output at 70 mc. The difference between the two readings should not exceed 30 watts.

(5) Check for oscillation as described in paragraph 244*e*. The amplifier has the greatest tendency to oscillate at 100 mc.

281. Final Testing of Power Supply PP–13(*)/TRA–1

a. Arrangement of Equipment.

(1) Connect the power supply output cables to the amplifier.

(2) Connect the power supply power input cable to a 115-volt, 60-cycle source.

(3) Connect an r-f wattmeter, Bird Corporation Model 67 or equal, to the amplifier ANTENNA socket.

(4) Connect the cable between the transmitter ANTENNA socket and the amplifier R-F INPUT socket.

(5) Tune the receiver, transmitter and amplifier for operation at any desired frequency.

(6) Connect an a-c voltmeter (0- to 150-volt scale) to one of the power supply sockets marked 115V 60 CYCLE OUTLET.

b. Hum Level. Listen to the receiver speaker during all the tests described in subparagraphs *c* and *e* below. There must be no hum, noise, rattling, or other extraneous sounds heard in the speaker.

c. Line Voltage. Set the amplifier TUNE OPERATE switch to OPERATE. The line voltmeter should indicate 115 volts. The filaments of the power supply rectifier tubes should light.

d. Plate Voltage. Set the amplifier METER SWITCH in the PLATE VOLTAGE position with the amplifier TUNE OPERATE switch on OPERATE, the bottom scale of the amplifier meter should indicate 1,800 minimum.

e. Current-Drain Check of High-Voltage Rectifiers.

(1) Set the amplifier METER SWITCH to the PLATE CURRENT position.

(2) Set the transmitter CARRIER CONTROL switch to position 4. The center scale of the amplifier meter should indicate 270.

f. Plate-Voltage Dropping Resistor. Set the amplifier TUNE OPERATE switch to TUNE. The bottom scale of the amplifier meter must indicate between 900 and 1,000 volts.

g. Bias Supply.

(1) Listen to the antenna relay. The relay must not vibrate (indicated by a low pitched humming sound).

(2) Touch the panel near the relay. Vibration should not be felt.

h. Screen Voltage.

(1) Set the transmitter CARRIER CONTROL switch to position 2.

(2) Set the TUNE OPERATE switch to OPERATE. The voltage regulator tubes should go on.

i. Interlock.

(1) Set the amplifier METER SWITCH to PLATE CURRENT.

(2) Open the power supply door. The needle on the amplifier meter must fall to 0.

j. Fuses.

(1) Remove fuse F303.

(2) Close the power supply door. The center scale of the amplifier meter must indicate zero.

(3) Open the door and replace the fuse. Close the door.

(4) Remove the power supply AMPLIFIER FUSE (F302).

(*a*) The amplifier meter should indicate zero on all scales.

(*b*) Tubes should not be lit in the amplifier or power supply.

(5) Replace the AMPLIFIER FUSE.

(6) Remove the power supply OUTLET FUSE.

(*a*) The 115V 60 CYCLE OUTLET receptacles should have 0 voltage on them.

(*b*) The amplifier tubes must remain lit.

k. CABLES. Twist and bend each power supply cable. There should not be a change in the meter indications. The tubes should not go out or flicker, and the set must not stop operating.

l. HIGH-VOLTAGE TIME-DELAY RELAY.

(1) Set the amplifier plate and filament ON-OFF switches to OFF.

(2) Wait until the tubes go out.

(3) Simultaneously snap both PLATE and FILAMENT switches to ON. Not less than 30 seconds after the switches have been snapped on, h-v relay TD301 must click and the amplifier meter must indicate 270 on the center scale.

m. CONTINUITY CABLE TEST.

(1) Connect the terminals of the ohmmeter to the following points on each cable:

(*a*) Between the ends of each conductor of each cable.

(*b*) Between adjacent conductors.

(*c*) Between the metal shell of the cable connectors and each conductor.

(2) Twist and bend each cable.

(*a*) Continuity must be indicated between the ends of each conductor of each cable.

(*b*) There must be an open circuit between adjacent conductors and between the metal shell and each conductor.

CHAPTER 8

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

282. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage.

a. Disconnect the inter-unit cording and cabling.

b. Take down the antenna and repack it. To do this, follow the antenna disassembly instructions given in paragraph 283. Repack the equipment by reversing the unpacking procedures given in paragraphs 61 and 62.

c. Remove the equipment from its shelter if it has been used inside a shelter.

d. Return the equipment to the cases in which it was shipped.

283. Lowering and Disassembling the Antenna

To lower the antenna, proceed as follows:

a. Place the guy plate on the gin pole.

b. Attach the block and tackle and the side guy ropes to the guy plate.

c. Chain the other end of the block and tackle assembly to the rear ground stake.

d. Adjust the length of the block and tackle assembly until it is taut.

e. Remove the rear guys from the ground stake and connect them to the gin pole guy plate.

f. Gently lower the mast by means of the block and tackle assembly.

g. Loosen all guys from their stakes and the gin pole guy plates. Remove the block and tackle from the rear stake. Remove Cord CD–800 or CG–107/U from the antenna dipole.

h. Remove the antenna dipole assembly from the mast.

i. Remove the top mast section.

j. Remove the guy plate containing the longest guys.

k. Remove three more mast sections.

l. Remove the next guy plate.

m. Remove three more mast sections.

n. If a 50-foot mast was used remove the final guy plate and the last mast sections.

284. Repacking for Shipment or Limited Storage

a. Carrying cases for all components have been designed to furnish adequate protection for their contents under all conditions of domestic shipment. This protection is not sufficient, however, for exporting the equipment. Additional packing is required for oversea shipment; refer to U. S. Army specification No. 100–14A for specific export packing instructions. In preparing equipment for oversea shipment, all tubes in transmitters and receivers not equipped with tube clamps should be held in place with masking tape to prevent damage.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the chassis. Protect the chassis with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATÉRIEL TO PREVENT ENEMY USE

285. General

The demolition procedures outlined in paragraph 286 will be used to prevent the enemy from using or salvaging the radio set or useful

parts of it. Demolition of the equipment will be accomplished only on order of the commander.

286. Methods of Destruction

a. SMASH. Smash the crystals, meters, tubes, controls, headsets, coils, microphones, relays, and power units, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or other heavy tools.

b. CUT. Cut cords and wiring, using axes, handaxes, or machetes.

c. BURN. Burn the technical manuals, cords, wiring, carrying bags, and capacitors, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. BEND. Bend the cases and chassis.

e. EXPLOSIVES. If explosives are necessary, use firearms, grenades, primacord, composition C, or TNT.

f. DISPOSAL. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them in streams.

g. DESTROY EVERYTHING.

APPENDIX 1

REFERENCES

Note. For availability of items listed, check SR 310-20-3 and SR 310-20-4. Check Department of the Army Supply Catalog SIG 1 for Signal Corps supply catalogs.

1. Army Regulations

AR 380–5	Safeguarding Military Information.
AR 750–5	Maintenance of Supplies and Equipment. (Maintenance Responsibilities and Shop Operation.)

2. Supply Publications

SIG 1	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 7&8	Organizational Maintenance Allowances and Field and Depot Maintenance Stockage Guide.
SB 11–6	Dry Battery Supply Data.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Publications on Auxiliary and Test Equipment

NAVSHIPS 91,118	Instruction Book for RF Wattmeter ME–11/U.
NAVSHIPS 91,254	Instruction Book for Tube Tester TV–3/U.
TO 16–35TS382–2	Instruction Book for Audio Oscillator TS–382A/U.
TM 11–300	Frequency Meter Sets SCR–211–(*).
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–1067A	Oscilloscope TS–34A/AP.
TM 11–1209	Test Set I–157–A (Tube and Set Tester, Precision Model 920P).
TM 11–2524	Oscillator I–151–A.
TM 11–2526	Oscilloscope BC–1060–A.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176, I–176–A, and I–176–B.
TM 11–2627	Tube Tester I–177 and I–177–A.
TM 11–2654	Vacuum Tube Voltmeter (Hickok Model 110–B).
TM 11–2684	Audio Oscillator TS–312/FSM–1 (Hewlett-Packard Model 200 CR).
TM 11–5017	Output Meter TS–585A/U.
TM 11–5030	Signal Generator TS–497A/URR.
TM 11–5500	Multimeter TS–297/U.
TM 11–5504	Electronic Multimeter TS–620A/U.
TM 11–5511	Electronic Multimeter TS–505/U.
TM 11–5522	Signal Generator Set AN/URM–27.
TM 11–5527	Multimeter TS–352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage

FM 5–20	Camouflage, Basic Principles.
TM 5–267	Camouflage.

6. Decontamination

TM 3–220	Decontamination.

7. Demolition

FM 5–25	Explosives and Demolitions.

8. Other Publications

FM 24–18	Field Radio Techniques.
FM 72–20	Jungle Warfare.
SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5	Report of Damaged or Improper Shipment.
TB SIG 4	Methods for Improving the Effectiveness of Jungle Radio Communication.
FM 24–18	Field Radio Techniques.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 54	Working through Jamming with Frequency Modulated Radio Sets.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 222	Solder and Soldering.
TB SIG 223	Field Expedients for Wire and Radio.
TM 11–314	Antennas and Antenna Systems.
TM 11–333	Telephones EE–8, EE–8–A, and EE–8–B.
TM 11–341	Telephone Terminal Sets TC–21–A and TC–21–B (Carrier) and Repeater Set TC–23–A (Carrier).
TM 11–342	Ringer Set TC–24 Ringing Equipments EE–100–T1, EE–100–A and EE–101–A (Voice Frequency).
TM 11–352	Printer TG–7–A and Teletypewriters TG–7–B and TG–37–B.
TM 11–354	Telegraph Printer Sets (Teletypewriter) EE–97 and EE–98; Teletypewriter Sets EE–97–A, EE–98–A and EE–102.
TM 11–355	Telegraph Terminal CF–2–A (Carrier).
TM 11–355B	Telegraph Terminal Set TC–22–B (Carrier).
TM 11–359	Line Units BE–77, BE–77–A, BE–77–B & BE–77–C.
TM 11–369	Spiral-Four Cable.
TM 11–415	Dry Batteries.
TM 11–453	Shop Work.

TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–477	Fixed Station Radio Repair and Maintenance (Personnel Training Text).
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–490	Electrical Fundamentals.
TM 11–660	Introduction to Electronics.
TM 11–661	Electrical Fundamentals (D-C Theory).
TM 11–680	Teletypewriter Circuits and Equipment (Fundamentals).
TM 11–2001	Complete 100-mile Spiral-four Carrier System.
TM 11–2008	Converter Set TC–33 (Carrier, 2-Wire-4-Wire) and Repeater Set TC–37 (Carrier, 2-Wire).
TM 11–2009	Telegraph Terminal CF–6 (Carrier).
TM 11–2201	Reperforator Teletypewriter Sets TC–16 and TC–17.
TM 11–2203	Teletypewriter Sets AN/TGC–1 and AN/TGC–1A AFM 102–2.
TM 11–2206	Telegraph Terminal Set AN/TCC–1, Telegraph Terminal TH–1/TCC–1, and Filter F–2/GG.
TM 11–2215	Teletypewriters TT–5/FG and TT–6/FG.
TM 11–2216	Teletypewriter TT–7/FG and TT–8/FG.
TM 11–2221	Receiving Transmitter Distributors Models 14AA, 14AB, 14AD, and 14ABM.
TM 11–2222	Transmitter Distributors Teletype Model 14.
TM 11–2223	Typing and Nontyping Reperforators, Teletype Model 14.
TM 11–2240	Wire Dispenser MX–306/G.
TM 11–2258	Facsimile Sets AN/TXC–1, –1A, and –1B.
TM 11–2606	Test Set AN/FSM–3, Tool Equipment TK–40/FSM–3, and Maintenance Kit MK–40/FSM–3 (Formerly Depot Crystal Equipment AN/FSM–1).
TM 11–2621	Remote Control Equipment AN/TRA–2, and AN/TRA–2A.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.
TM 11–4400	Telephone Terminal CF–1–A (Carrier) Repair Instructions Operational Requirements.
TM 11–4401	Telegraph Terminal CF–2–A (Carrier) Repair Instructions, Operational Requirements.
TM 11–4402	Telegraph Terminal CF–2–B (Carrier) and CF–6 (Carrier) Repair Instructions, Operational Requirements.
TM 11–4409	Ringing Equipments, EE–100–T–1, EE–100–A (Voice Frequency) and EE–101–A (Voice Frequency)—Repair Instructions, Operational Requirements.
TM 11–4413	Telegraph Terminal TH–1/TCC–1, Repair Instructions, Operational Requirements.

9. Abbreviations

a-c........alternating-current
a-f........audio-frequency
A........ampere
ampl........amplifier
ANT........antenna
BP........bandpass
C........Centigrade
cps........cycles per second
c-w........continuous wave
db........decibel
dbm........decibels referred to 1 milliwatt
DBLR........doubler
d-c........direct-current
DISCR........discriminator
E........enameled
emf........electromagnetic force
F........Fahrenheit
f-m........frequency-modulated
ga........gauge

h	high
hex	hexagonal
h-f	high-frequency
h-v or H.V.	high-voltage
i-f	intermediate-frequency
K	kilo or 1,000
kc	kilocycle
kw	kilowatt
lb	pound(s)
l-f	low-frequency
lg	long
LIM	limiter
LP	low-pass
ma	milliampere
max	maximum
mc	megacycle
MEG	megohm
mh or MH	millihenry
min	minimum
mm	millimeter
mtg	mounting
mtg/c	mounting center
mv	millivolt
mw	milliwatt
osc	oscillator
P.A.	power amplifier
pl	plated
PRI	primary
RCVG	receiving
RCVR	receiver
RECT	rectifier
r-f	radio-frequency
rms	root mean square
rpm	revolutions per minute
SD	Solvent, dry cleaning
SEL	selenium
SEC	secondary
SH	shield
SLC	straight line capacity
SOP	Standing Operating Procedure
TEL	telephone
term	terminal(s)
thk	thick
TRSG	transmitting
ua	microampere
UF or μf	microfarad
UUF or $\mu\mu f$	micromicrofarad
uv	microvolt
uw	microwatt
v or V	volt
v-f	voice-frequency
vhf	very high frequency
VTVM	vacuum-tube voltmeter
wd	wide
XMTG	transmitting
XMTR	transmitter
XTAL	crystal
~	cycles per second
ZI	zone of interior

APPENDIX II
IDENTIFICATION TABLE OF PARTS

Note 1. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O & E, T/A, SIG 6, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8–AN/TRC–4. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

Note 2. Parts for the unlettered models are ordinarily the same as those for the A model. Refer to the partial schematics for exact values.

1. Identification Table of Parts for Radio Set AN/TRC–1

Ref symbol	Models A through E	Model G, Army, Navy and Air Force	Model G, Navy—outside ZI	Name of part and description	Function of part	Signal Corps stock No.
				RADIO SET AN/TRC–1 A, B, C, D, E, G: portable; fm; 10- or 50-w output; Sig C spec #271–3010.	To transmit and receive f-m signals.	2S5002–1.1
		(*)	(*)	ACCESSORY KIT No. 1 (described in par. 13, app. II).	To help maintain and operate set.	2S5002–3–1
	(*)	(*)	(*)	TOOL, ALIGNMENT: TL–601/U (TL–150 on some procurements); steel blade 1/8" wd x 0.029" thk one end, ins knob other end; (part of Accessory Kit No. 1).	To aline Radio Receiver R–19(*)/TRC–1.	6R38496.2
	(*)	(*)	(*)	ANTENNA: Army-Navy Antenna System AS–19(*)/TRC–1; dipole array type; freq range 70 to 99.9 mc.	To radiate and receive radio waves.	2A264–19
	(*)			ANTENNA EXTENSION KIT MX–141/TRC–1.	To extend antenna height from 40 feet to 50 feet.	2A1591–141
	(*)	(*)	(*)	CABLE ASSEMBLY, power: Army-Navy Cord CX–104/TRC–1; uses Sig C Cordage CO–137; 10 ft 10" lg excluding term (part of Accessory Kit No. 1).	Interconnect receiver and transmitter.	3E6000–104
	(*)	(*)	(*)	CABLE ASSEMBLY, power: Sig C Cord CD–711; 2 cond #14 AWG stranded; 50 ft lg excluding term (part of accessory kit No. 1).	Connects Power Unit to Junction Box JB–110; or between Junction Boxes J–85/G and JB–110.	3E1711
	(*)	(*)	(*)	CABLE ASSEMBLY, RF: Army-Navy Cord CG–107/U (or Sig C Cord CD–800): coaxial; flexible; characteristic impedance 52 ohms; 40" lg; 3 ft 7" lg o/a; solid dielectric; w/Plug PL–259 at ea end (RF transmission line).	R-f transmission line	1F430–107.40
		(*)	(*)	CLAMP: 1¼" to 3" cap. (part of rhombic kit).	Masthead halyard support.	2Z2635.117
	(*)	(*)	(*)	CORD: Sig C Cord CD–318; uses Cordage CO–145 or CO–122–A and Cordage CO–199–B; 8 ft lg o/a excluding term (part of Accessory Kit No. 1).	Microphone extension cord.	3E1318
	(*)	(*)	(*)	CORD: Sig C Cord CD–874; 2 tinsel cond; 6½ ft lg excluding term (part of accessory kit No. 1).	Headset extension cord	3E1874
	(*)	(*)	(*)	CRYSTAL UNIT, quartz: Army-Navy Crystal Unit CR–6/U; c/o one quartz xtal plate mtd in Crystal Holder FT–243; 16 units for Army outside ZI; 4 units for Air Force outside ZI; 6 units for Navy outside ZI; for freq and stock No. of individual crystal see paragraph 20.	For frequency control of receiver.	

Ref symbol	Models A through E	Model G, Army, Navy and Air Force	Model G, Navy—outside ZI	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	CRYSTAL UNIT, quartz: Crystal Unit CR-4/U; c/o one quartz xtal plate mtd in Crystal Holder FT-243; 16 units for Army outside ZI; 4 units for Air Force outside ZI; 6 units for Navy outside ZI; for freq and stock No. of individual xtal see paragraph 20.	For frequency control of transmitter.	
	(*)	(*)	(*)	HANDSET: H-23/U, H-23A/U, H-23B/U, H-23C/U; transmitter impedance 25 ohms; receiver impedance 256 ohms.	Converts sound to pulsating dc; and pulsating dc to sound.	2B620-23
	(*)	(*)	(*)	HEADSET: Sig C Headset HS-30, -A, -B, -C, -D, -E, -F, -G, -H, -J, -K, -L, -R, -U; magnetic type; 250 ohm impedance (part of Accessory Kit No. 1).	Converts sound to pulsating dc; and pulsating dc to sound waves.	2B830
		(*)	(*)	INSERT: Sig C Insert M-300 (part of Accessory Kit No. 1).	Individual ear pieces for Headset HS-30-(*).	2B1300
		(*)	(*)	JUNCTION BOX: Sig C Junction Box JB-110; for ½″ conduit or ½″ diam cable (part of Accessory Kit No. 1).	To connect a maximum of 10 two-cond power cords to one outlet.	6Z1041
	(*)	(*)	(*)	LAMP: incandescent; 120 v; 50 w; med screw base.	Used as dummy antenna or for trouble lamp.	6Z6820-1
	(*)	(*)	(*)	LAMPHOLDER ASSEMBLY: brass; olive drab E finish; for 50w lamp; med screw base.	Used for making up dummy antenna.	6Z5984.6
	(*)	(*)	(*)	LIGHT, extension: 25 ft lg (Part of Accessory Kit No. 1); includes bulb, 50/60w, 115 v, screw type base; GE Mazda #50A/RS, or equal.	Trouble lamp	6Z6897-2
	(*)	(*)	(*)	MICROPHONE: Sig C Microphone T-45; impedance 100 ohm; unidirectional (part of accessory kit No. 1).	Convert sound waves to pulsating dc.	2B1645
	(*)	(*)	(*)	POWER UNIT PE-75-C, -D, -J, -K, -M, -S, -T, -V, -W, -AA, -AB, -AC, -AD, -AE; rated 2.5 kva, 2500 w, 100% power factor; 120v, single phase, 60 cycle, 3 wire.	Provide power for radio set.	3H4575
	(*)	(*)	(*)	PULLER, tube: TL-201 (part of accessory kit No. 1).	Help remove tubes	6R7442
	(*)	(*)	(*)	PULLER, tube: 7⅛″ lg x 1⅜″ wd (part of accessory kit No. 1).	Help remove tubes	6R7443-2
	(*)	(*)	(*)	RADIO RECEIVER R-19(*)/TRC-1: FM; freq. range 70.0 to 99.9 mc.	Receive f-m signals	2C4180-19
	(*)	(*)	(*)	RADIO TRANSMITTER T-14(*)/TRC-1: FM; freq range 70.0 to 99.9 mc; 50w max, low power.	Transmits f-m signals	2C6900-14
	(*)	(*)	(*)	RESISTOR: fixed; comp; 600 ohms ±10%; 118w; 18″ lg x 1″ dia (part of rhombic kit).	Terminating resistor	3Z6060-77
		(*)	(*)	SCREWDRIVER: slotted drive; 2″ blade; ⅛″ wd x .031″ thk bit (part of accessory kit No. 1).	Tighten and remove screws.	6R15292
		(*)	(*)	SCREWDRIVER: TL-360/U; 6″ blade; 3/16″ wd x approx 3/64″ thk bit (part of accessory kit No. 1).	Tighten and remove screws.	6R16091
	(*)	(*)	(*)	SHIELD: breath; microphone; spring steel; approx ⅜″ wd x 9/32″ h x 13/32″ d.	Keep breath from condensing on Microphone T-45.	2B1589/1

1. Identification Table of Parts for Radio Set AN/TRC–1—(Continued)

Ref symbol	Models A through E	Model G, Army, Navy and Air Force	Model G, Navy—outside ZI	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	TEST OSCILLATOR: TS–32(*)/TRC–1; FM; freq range 70.0 to 99.9 mc; powered by Radio Receiver R–19(*)/TRC–1 (part of accessory kit on some procurements).	Emits test signal for alinement of receiver.	3F4325–32
	(*)	(*)	(*)	WIREBRAID: tinned copper 11⁄16″ wd; opens to 1¼″.	For making up rhombic coupling system.	1F6C1–11

2. Identification Table of Parts for Radio Terminal Set AN/TRC–3(*)

Ref symbol	Models		Name of part and description	Function of part	Signal Corps stock No.
	A through E	G			
			RADIO TERMINAL SET AN/TRC–3(*): FM; xmtr output 50 w max, 10 w on lower power; 70 to 99.9 mc, 300 channels.	Radio terminal set used for continuous operation.	2S5002–3
		(*)	ACCESSORY KIT NO. 1: (For list of items see par. 13.) (Used in place of Maintenance Equipment MK–4(*)/TRC–1 (A through E models).)	Contains operational and maintenance items.	2S5002–3–1
		(*)	ACCESSORY KIT NO. 2: (For list of items see par. 14.) (Used in place of Maintenance Equipment MK–5(*)/TRC–3 (A through E models).)	Contains operational and maintenance items.	2S5002–3–8
	(*)	(*)	ALINEMENT TOOL: Alignment Tool TL–601/U; steel blade ⅛″ wd x .029″ thk end, ins knob other end (p/o accessory kits #1 and 2).	For alining receiver______	6R38496.2
	(*)	(*)	ANTENNA SYSTEM: Antenna System AS–19(*)/TRC–1; c/o Antenna AS–20(*)/TRC–1 and Antenna Support AB–33(*)/TRC–1.	For reception and radiation of radio waves.	2A264–19
	(*)	(*)	CABLE ASSEMBLY, power: Cord CD–711; two #14 AWG stranded cond; 50 ft lg excluding term (p/o Accessory Kits #1 and #2).	Used to connect Power Unit PE–75–(*) to Junction Box JB–110, or between Junction Boxes JB–110 and J–85/G.	3E1711
	(*)	(*)	CABLE ASSEMBLY, power: Cord CX–104/TRC–1; uses Cordage CO–137; 10 ft 10″ lg excluding term (p/o accessory kit #1 and some accessory kits #2).	Interconnects transmitter and receiver.	3E6000–104
	(*)	(*)	CABLE ASSEMBLY, telephone: Cable Stub CC–356–(*); uses Cable WC–548; 12 ft lg excluding term.	To terminate spiral-4 cable to transmitter panel.	3E356
		(*)	CABLE ASSEMBLY, telephone: Cable Assembly CC–368–(*); uses Cable WC–548; 100 ft lg.	Extension for spiral-4 termination.	3E368
	(*)	(*)	CABLE ASSEMBLY, RF: Cord CG–107/U (or CD–800); coax; characteristic impedance 52 ohms; 40″ lg; single #21 AWG copper axial cond comprising 7 strands; w/Plug PL–259 at ea end (p/o accessory kit #1).	Used to interconnect antenna circuits of receiver and transmitter.	1F430–107.40
	(*)	(*)	CLAMP: mast head halyard; 2 sect; steel; olive drab E; one sect 17″ lg x 2 3⁄16″ wd, other 4″ lg x 2 3⁄16″ wd; w/2 eyebolts 2½″ lg x ⅝″ ID.	Support of rhombic antenna.	2Z2635.117
	(*)	(*)	CORD: Cord CD–874; 2 tinsel cond; 3½ ft lg excluding term.	Headset extension cord___	3E1874–42

Ref symbol	Models A through E	Models G	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	CORD: Cord CD-318; uses Cordage CO-145 or CO-122-A and Cordage CO-199-B; 8 ft lg o/a excluding term.	Microphone extension cord.	3E1318
	(*)	(*)	CRYSTAL UNIT SET: Crystal Unit CR-4/U; 300 xtal in set (for freq and stk No. of ea see par. 20) (crystals not supplied with some G models).	For determination of transmitter frequency.	
	(*)	(*)	CRYSTAL UNIT SET: Crystal Unit CR-6/U; 300 xtal in set (for freq and stk No. of each see par. 20). (xtal not supplied with some G models).	For frequency determination of receiver.	
	(*)	(*)	FLASHLIGHT: Flashlight TL-122; right angle; tubr; 2 cell, focusing; incl Lamp LM-19 (p/o some accessory kits #2).	To light up equipment while trouble shooting.	6Z4002
	(*)	(*)	HANDSET: Handset H-23(*)/U; xmtr impedance 25 ohms; rec impedance 256 ohms (p/o accessory kit #1).	Convert sound to pulsating dc and pulsating dc to sound.	2B620-23
	(*)	(*)	HEADSET: Headset HS-30-(*); magnetic type; 250 ohms impedance (p/o accessory kit #1).	Convert sound to pulsating dc and pulsating dc to sound.	2B830
	(*)	(*)	INSERT: Insert M-300 (p/o accessory kit #1)	Ear piece for headset	2B1300
	(*)	(*)	JUNCTION BOX: Junction Box JB-110; c/o 10 ft cord, w/10 female sockets; 12¼" lg x 4½" wd x 2¼" d (p/o accessory kits #1 and #2).	To connect a-c power	6Z1041
	(*)	(*)	JUNCTION BOX: Junction Box J-85/G (may not be supplied with ZI equipment).	Connect either of two power units to radio equipment.	2Z5600-85
	(*)	(*)	KNIFE: Knife TL-29; electrician's; steel; 3⅝" lg closed; 1 blade and one scdr blade w/safety lock (p/o accessory kit #2 with some G models).	For repair of equipment	6Q60229
	(*)	(*)	LAMP: incandescent; 120 v, 50 w	Dummy antenna or as part of trouble lamp.	6Z6820-1
	(*)	(*)	LAMPHOLDER: med screw base	To make up dummy ant	2Z5984.6
	(*)	(*)	LIGHT: extension; 25 ft lg excluding term	Trouble lamp	6Z6897-2.1
	(*)	(*)	MICROPHONE: Microphone T-45; impedance 100 ohms; unidirectional (p/o accessory kit #1).	Convert sound to pulsating dc.	2B1645
		(*)	MULTIMETER: Multimeter TS-352/U (with late G models only).	For trouble shooting	3F4325-352
		(*)	MULTITESTER: Multimeter TS-297/U (with early G models only).	For trouble shooting	3F4325-297
	(*)	(*)	PLIERS: Pliers TL-103; diagonal cutting; w/cutters; 5" lg (p/o accessory kit #2 with some G models).	For cutting wire	6R4603
	(*)	(*)	PLIERS: Pliers TL-125; 8" lg (p/o accessory kit #2 with some G models).	For maintenance	6R4625
	(*)	(*)	PLIERS: Pliers TL-126; chain nose; w/o cutters; 6½" lg o/a (p/o accessory kit #2 with some G models).	For maintenance	6R4626
	(*)	(*)	POWER UNIT: Power Unit PE-75-(*); 2.5 kva, 2500 w 100% power factor; 120 v single ph; 60 cyc, 3 wire.	Provides power for radio relay set.	3H4575
	(*)	(*)	PULLER, tube: p/o accessory kit #1 and some #2	Helps remove tubes	6R7443-2
	(*)	(*)	PULLER, tube: Tube Puller TL-201 (p/o accessory kit #1 and some accessory kits #2).	Helps remove tubes	6R7442
	(*)	(*)	RADIO RECEIVER: Radio Receiver R-19(*)/TRC-1; FM; 70 to 99.9 mc.	Receives f-m signals	2C4180-19
	(*)	(*)	RADIO TRANSMITTER: Radio Transmitter T-14 (*)/TRC-1; FM; 70 to 99.9 mc.	Transmits f-m signals	2C6900-14
	(*)	(*)	RESISTOR, fixed: comp; 600 ohms, ±10%; 118 w	Rhombic antenna termination.	3Z6060-77

2. Identification Table of Parts for Radio Terminal Set AN/TRC–3(*)—(Continued)

Ref symbol	Models A through E	Models G	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	SHIELD: breath	Keep moisture from microphone.	2B1589/1
	(*)	(*)	SOLDERING IRON: Soldering Iron TL–117; 110 v; 70/100 w (p/o accessory kit #2 with some G models).	For soldering connections	6R24617
	(*)	(*)	TEST OSCILLATOR: Test Oscillator TS–32(*)/TRC–1; contains RF osc which may be ph modulated by a 1,000 cyc note.	For alinement of receiver	3F4325–32
	(*)		TEST SET: Test Set I–56–K; c/o Voltohmmeter I–166, Test Unit I–176, and Tube Tester I–177 in test leads and carrying Case CS–130.	For trouble shooting	3F4056K
		(*)	TUBE TESTER: Tube Tester I–177; mutual conductance type.	Tests tubes	3F5700–177
	(*)	(*)	WHISTLE: 1000 cps (p/o accessory kit #2 on some models).	Audio signal for testing receiver.	6R38049/W1
	(*)	(*)	WIRE: Wire WD–1/TT (or W–110–B); 1 mile lg on Reel DR–4.	Field wire	1B190–1.2
	(*)	(*)	WIRE BRAID: tinned copper; 11/16″ wd x 72″ lg; opens to 1¼″ ID.	Part of rhombic kit	1F6C1–11.72

3. Identification Table of Parts for Radio Relay Set AN/TRC–4(*)

Ref symbol	Models A through E	Models G	Name of part and description	Function of part	Signal Corps stock No.
			RADIO RELAY SET AN/TRC–4(*); transportable; FM; 50 w max, 10 w low power; 70 to 99.9 mc; 300 channels.	Relay station of a single or multi-channel radio relay communication system when continuous operation is required.	2S5002–4
		(*)	ACCESSORY KIT NO. 1: (for list of items see par. 13); (Used in place of Maintenance Equipment MK–4(*)/TRC–1 (A through E models)).	Contains operational and maintenance items.	2S5002–3–1
		(*)	ACCESSORY KIT NO. 2: (for list of items see par. 14); (Used in place of Maintenance Equipment MK–5(*)/TRC–3 (A through E models)).	Contains operational and maintenance items.	2S5002–3–8
		(*)	ACCESSORY KIT NO. 3: (for list of items see par. 15); (used in place of Maintenance Equipment MK–6(*)/TRC–4 (A through E models)); (not used on late G models).	Contains operational and maintenance items.	2S5002–4–1
	(*)	(*)	ALINEMENT TOOL: Alignment Tool TL–601/U; steel blade ⅛″ wd x .029″ thk end, ins knob other end (p/o accessory kits #1, #2 and #3).	For alining receiver	6R38496.2
	(*)	(*)	ANTENNA SYSTEM: Antenna System AS–19(*)/TRC–1; c/o Antenna AS–20(*)/TRC–1 and Antenna Support AB–33(*)/TRC–1.	For reception and radiation of radio waves.	2A264–19
	(*)	(*)	CABLE ASSEMBLY, power: Cord CD–711; two #14 AWG stranded cond; 50 ft lg excluding term (p/o accessory kits #1, #2, and #3).	Used to interconnect Power Unit PE–75–(*) to Junction Box JB–110; or between Junction Boxes J–85/G and JB–110.	3E1711

Ref symbol	Models A through E	Models G	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	CABLE ASSEMBLY, power: Cord CX-104/TRC-1; uses Cordage CO-137; 10 ft 10″ lg excluding term (p/o accessory kits #1 and #3 and some of #2).	Interconnects transmitter and receiver.	3E6000-104
	(*)	(*)	CABLE ASSEMBLY: Cord CG-107/U (or CD-800); coax; characteristic impedance 52 ohms; 40″ lg; w/Plug PL-259 at ea end (p/o accessory kit #1).	Used to interconnect antenna circuits of receiver and transmitter.	1F430-107.40
	(*)	(*)	CLAMP: 2 sect; steel; one sect 17″ lg x 2$\frac{3}{16}$″ wd; other 4″ lg x 2$\frac{3}{16}$″ wd; w/2 eyebolts.	Support of rhombic antenna.	2Z2635.117
			CONTROL BOX: Control Box C-21(*)/TRC-1; provided w/2 plugs and 2 jacks and a 4 PDT toggle switch; 4$\frac{7}{8}$″ lg x 3$\frac{1}{4}$″ d x 2$\frac{1}{8}$″ h (p/o accessory kit #3).	Controls transferring of the input and output circuits of 2 transmitters.	2C666-21
	(*)	(*)	CORD: Cord CD-874; 2 tinsel cond; 3$\frac{1}{2}$ ft lg excluding term.	Headset extension cord	3E1874-42
	(*)	(*)	CORD: Cord CD-318; uses Cordage CO-145 or CO-122-A and Cordage CO-199-B; 8 ft lg excluding term.	Microphone extension cord.	3E1318
	(*)	(*)	CRYSTAL UNIT SET: Crystal Unit CR-4/U; 16 xtal in set (for freq and stk No. of ea see par. 20); (may not be supplied with Z/I models).	For determination of transmitter frequency.	
	(*)	(*)	CRYSTAL UNIT SET: Crystal Unit CR-6/U; 16 xtal in set (for freq and stk No. of ea see par. 20); (may not be supplied with Z/I models).	For determination of receiver frequency.	
	(*)	(*)	FLASHLIGHT: Flashlight TL-122; right angle; tubr; 2 cell focusing (p/o accessory kits #2 (some models) and #3).	Provides light while trouble shooting.	6Z4002
	(*)	(*)	HANDSET: Handset H-23(*)/U; xmtr impedance 25 ohms; rec impedance 256 ohms (p/o accessory kit #1).	Converts sound to pulsating dc and pulsating dc to sound.	2B620-23
	(*)	(*)	HEADSET: HS-30-(*): magnetic type 250 ohms impedance (p/o accessory kit #1).	Converts sound to pulsating dc and pulsating dc to sound.	2B830
	(*)	(*)	INSERT: Insert M-300 (p/o accessory kits #1 and #3).	Earpiece for headset	2B1300
	(*)	(*)	JUNCTION BOX: Junction Box JB-110; c/o of 10 ft cord w/10 female AC sockets; 12$\frac{1}{4}$″ lg x 4$\frac{1}{2}$″ wd x 2$\frac{1}{4}$″ d (p/o accessory kits #1 and #2).	To connect ac power	6Z1041
	(*)	(*)	JUNCTION BOX: Junction Box J-85/G (may not be supplied with Z/I equipment); (p/o accessory kits #2 and #3).	Connects either of two power units to radio equipment.	2Z5600-85
	(*)	(*)	KNIFE: Knife TL-29; electrician's; steel; 3$\frac{5}{8}$″ lg closed (p/o accessory kit #2 with some G models).	For repair of equipment	6Q60229
	(*)	(*)	LAMP: incandescent; 120 v; 50 w	Dummy antenna or part of trouble lamp.	6Z6820-1
	(*)	(*)	LAMPHOLDER: med screw base	To make up dummy antenna.	2Z5984.6
	(*)	(*)	LIGHT: extension; 25 ft lg excluding term	Trouble lamp	6Z6897-2.1
	(*)	(*)	MICROPHONE: Microphone T-45; 100 ohms impedance (p/o accessory kit #1).	Converts sound to pulsating dc.	2B1645
		(*)	MULTIMETER: Multimeter TS-352/U (with late G models only).	For trouble shooting	3F4325-352
		(*)	MULTIMETER: Multimeter TS-297/U (with early G models only).	For trouble shooting	3F4325-297
	(*)	(*)	PLIERS: Pliers TL-103; diagonal cutting; 5″ lg (p/o accessory kit #2 on some models).	For cutting wire	6R4603
	(*)	(*)	PLIERS: Pliers TL-125; 8″ lg (p/o accessory kit #2 on some models).	For maintenance	6R4625

3. Identification Table of Parts for Radio Relay Set AN/TRC–4(*)—(Continued)

Ref symbol	Models A through E	Models G	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	PLIERS: Pliers TL–126; chain nose; w/o cutters; 6½″ lg o/a (p/o accessory kit #2 with some models).	For maintenance	6R4626
	(*)	(*)	POWER UNIT: Power Unit PE–75–(*); 2.5 kva, 2500 w, 100% power factor; 120 v single ph, 60 cyc, 3 wire.	Provide power for set operation.	3H4575
	(*)	(*)	PULLER, tube: p/o accessory kits #1, some #2's, and #3.	Helps remove tubes	6R7443–2
	(*)	(*)	PULLER, tube: Tube Puller TL–201 (p/o accessory kits #1, some #2's and #3).	Helps remove tubes	6R7442
	(*)	(*)	RADIO RECEIVER: Radio Receiver R–19(*)/TRC–1; FM; 70 to 99.9 mc.	Receives f-m signals	6C4180–19
	(*)	(*)	RADIO TRANSMITTER: Radio Transmitter T–14(*)/TRC–1; FM; 70 to 99.9 mc.	Transmits f-m signals	2C6900–14
	(*)	(*)	RESISTOR, fixed: comp; 600 ohms ±10%; 118 w	Rhombic antenna termination.	3Z6060–77
	(*)	(*)	SHIELD: breath	Keeps moisture from microphone.	2B1589/1
	(*)	(*)	SOLDERING IRON: Soldering Iron TL–111; 110 v; 70/100 w (p/o accessory kit #2 on some models).	For soldering connections	6R24617
	(*)	(*)	TEST OSCILLATOR: Test Oscillator TS–32(*)/TRC–1; r-f osc which may be ph modulated by a 1,000-cyc note.	For alinement of receiver	3F4325–32
	(*)		TEST SET: Test Set I–56–K; c/o voltohmmeter I–166, Test Unit I–176, and Tube Tester I–177.	For trouble shooting	3F4056K
		(*)	TUBE TESTER: Tube Tester I–177; mutual conductance type.	Tests tubes	3F5700–177
	(*)	(*)	WHISTLE: 1000 cps (p/o accessory kits #2 and #3 w/some models).	Audio signal for testing receiver.	6R38049/W1
	(*)	(*)	WIRE: Wire WD–1/TT (or W–110–B); 1 mile lg on Reel DR–4.	Field wire	1B190–1.2
	(*)	(*)	WIRE BRAID: tinned copper; 11/16″ wd x 72″ lg; opens to 1¼″ ID.	Part of rhombic kit	1F6C1–11.72
		(*)	WIRE DISPENSER: Wire Dispenser MX–306A/G; w/½ mile of Wire WD–1( )/TT; dispenser constructed of tape and canvas; 13½″ dia x 5½″ wd.	Dispenses wire	6H9100–306A

4. Identification Table of Parts for Amplifier Equipment AN/TRA–1(*)

Ref symbol	Models A	B	C	D	Name of part and description	Function of part	Signal Corps stock No.
Fig. 4	---	---	---	---	AMPLIFIER EQUIPMENT AN/TRA–1A, B, C, and D: freq range 70 to 100 mc; output 250 w; input 115 V, 50/60 cyc c/o Amplifier AM–8(*)/TRA–1 and Power Supply PP–13(*)/TRA–1; mtd in cases CY–15(*)/TRA–1 (Sig C stock No. 2Z1891–15) and CY–16(*)/TRA–1 (Sig C stock No. 2Z1891–16); Sig C Spec #71–3022.	Increase transmitting distance of Radio Transmitter T–14(*)/TRC–1.	2S5006–1
	(*)	(*)	(*)	(*)	CABLE ASSEMBLY, RF: Cord CG–107/U; uses Radio Frequency Cable RG–8A/U; 43″ lg o/a.	Connect amplifier to transmitter.	1F430–107.40

5. Identification Table of Parts for Antenna System AS-19(*)/TRC-1

Ref symbol	Models A	B	C	D	E	F	Name of part and description	Function of part	Signal Corps stock No.
Fig. 5	---	---	---	---	---	---	ANTENNA: Army-Navy Antenna System AS-19 A, B, C/TRC-1; 3 element horizontally pol directional dipole array; elements are brass w/dull gray chromium finish; array c/o 1 director, 1 radiator, and 1 reflector; can be rotated by hand; tunable to any freq between 70 mc to 100 mc; 52 ohm coaxial transmission line feed; contains all necessary equipment to erect antenna array; 40 ft h.	Complete receiving and transmitting antenna.	2A264-19
Fig. 63	---	---	---	---	---	---	ANTENNA: Army-Navy Antenna System AS-19D/TRC-1; dipole; 70 to 99.9 mc; 50 ft h.	Complete receiving and transmitting antenna.	2A264-19D
Figs. 17 and 63.	---	---	---	---	---	---	ANTENNA: Army-Navy Antenna System AS-19E, F/TRC-1; dipole; 70 to 99.9 mc; approx 50 ft h horizontal or vertical pol.	Complete receiving and transmitting antenna.	2A264-19E
	(*)	(*)	(*)	---	---	---	ANTENNA: AS-20A, B, C/TRC-1; horizontally pol directional dipole brass, dull-gray chromium finish; array c/o 1 director, 1 radiator, and 1 reflector; 37″ lg x 45″ wd max, 24″ wd min; assembled to top of mast; can be rotated by hand; tunable to any freq between 70 mc and 100 mc; 52 ohm coaxial transmission line feed.	Radiates signal	2A202AS-2
	---	---	---	(*)	---	---	ANTENNA: Army-Navy Antenna AS-20D/TRC-1; dipole; 70 to 99.9 mc; horizontally pol.	Radiates signal	2A202AS-20 D
	---	---	---	---	(*)	---	ANTENNA: Army-Navy Antenna AS-20E/TRC-1; dipole; 70 to 99.9 mc; horizontally pol.	Radiates signal	2A202AS-20E
Fig. 40	---	---	---	---	---	(*)	ANTENNA: Army-Navy Antenna AS-20F/TRC-1; dipole; 70 to 99.9 mc; horizontally or vertically pol.	Radiates signal	2A202AS-20F
	(*)	(*)	(*)	(*)	---	---	SUPPORT, antenna: AB-33A/TRC-1, mtg for Antenna AS-20( )/TRC-1; c/o Antenna Mast Sections AB-101/TRC-1, Guy Plates MX-552/TRC-1, Guys MX-555/U, Mast Base AB-102/TRC-1, and other auxiliary parts; mast sect, steel painted olive drab; 10 mast sect assembled together give a pole approx 40 ft h; separate components marked w/item names; U. S. Army spec 71-3010.	Supports antenna array	2A248-33A
	---	---	---	---	(*)	---	SUPPORT, antenna: AB-33B/TRC-1; 50 ft mast.	Supports antenna array	2A248-33B
	---	---	---	---	---	(*)	SUPPORT, antenna: AB-33C/TRC-1; 50 ft mast.	Supports antenna array	2A248-33C
	(*)	(*)	(*)	(*)	(*)	(*)	STRAP ST-18	For bundling mast sections (four used).	2Z9018

Ref symbol	Models A	Models B	Models C	Models D	Name of part and description	Function of part	Signal Corps stock No.
	---	---	---	---	GENERATOR, RF signal: Army-Navy Test Oscillator TS–32(*)/TRC–1; FM modulation; 70 to 100 mc w/selected plug-in crystal; metal chassis and cover w/snap action catches; 7 lg x 4 d x $4\frac{3}{4}''$ h; crystal-controlled freq approx 1000 cyc internal modulation provided; fil and plate cur obtained from Radio Receiver R–19( )/TRC–1 through extra socket provided on receiver; incl 1 set of spare tubes and Cord CG–107/U (40″); per spec MIL–R–10174.	Emits f-m test signal for alining Radio Receiver R–19(*)/TRC–1.	3F4325–32
E401	(*)	(*)	(*)	---	BOARD, terminal: 5 turret type solder lug term; 1 row of 2 term and 1 row of 3 term w/$\frac{9}{16}''$ between rows and $\frac{5}{8}''$ min between term; natural plastic, type LTS–E–5 per JAN–P–13; $2\frac{15}{16}''$ lg x 1″ wd x $\frac{3}{32}''$ thk, w/term $\frac{7}{16}''$ thk; two $\frac{5}{32}''$ diam mtg holes on 2.5″ mtg/c; two $\frac{1}{8}''$ diam holes on $1\frac{7}{32}''$ ctr; Hallicrafters part/dwg #88B636; fungus resistant per spec JAN–C–173.	Mounting for resistors, capacitors, and coils.	3Z770–5.26
E402	(*)	(*)	(*)	---	BOARD, terminal: 31 brass eyelet term, 1 row of 15 and 1 row of 16; $\frac{7}{8}''$ between rows and $\frac{1}{4}''$ between term; natural plastic, LTS–E–5, per JAN–P–13; $4\frac{11}{16}''$ lg x $1\frac{1}{4}''$ wd x $\frac{1}{16}''$ thk; two $\frac{5}{32}''$ diam mtg holes on 4.375″ mtg/c; Hallicrafters part/dwg #88B622; fungus resistant per spec JAN–C–173.	Mounts resistors and capacitors.	3Z770–31.4
E405	---	---	---	(*)	BOARD, terminal: plastic; 4 double end solder lug term; w/o barriers; $1\frac{15}{16}''$ lg x 1″ wd x $\frac{3}{32}''$ thk; two mtg holes $\frac{1}{8}''$ on $1\frac{17}{32}''$ mtg ctr; Bellaire Electronics part #BE–T–3.	Mounts resistors and capacitors.	3Z770–4.122
E402	---	---	---	(*)	BOARD, terminal: plastic; 32 eyelet type term; w/o barriers; $4\frac{3}{4}''$ lg x $1\frac{1}{4}''$ wd x $\frac{1}{16}''$ thk; 2 mtg holes $\frac{3}{16}''$ diam on $4\frac{3}{8}''$ mtg ctr; Bellaire Electronics part #BE–T–2.	Mounts resistors and capacitors.	3Z770–32.14
	---	---	---	---	BRACKET: "L" shape; brass; $\frac{5}{8}''$ lg x $\frac{11}{32}''$ wd x $\frac{3}{8}''$ d; mts by 2 holes, in lg leg .161″ diam, in short leg .128″ diam; Bellaire Electronics part #BE–T–8.	Holds and supports coil	2Z1244–172
	---	---	---	---	BRACKET: "Z" shape; brass; $\frac{13}{16}''$ lg x $\frac{11}{16}''$ wd x $\frac{3}{8}''$ d; mts by hole .128″ diam and slot .156″ wd by $\frac{1}{2}''$ d; Bellaire Electronics part #BE–T–7.	Holds and supports coil	2Z1244–171
PC401	(*)	(*)	(*)	(*)	CABLE ASSEMBLY, power: three #18 stranded AWG cond; rubber ins; 300 v working; cotton wrap, rubber, cotton wrap, rubber sheath; round .255″ diam; $31\frac{1}{2}''$ lg excluding terminations; 1 end terminated in plug, Amphenol part #PM8–11; other end terminated in stripped and tinned leads; Belden per Hallicrafters part/dwg #87B1700.	Power cord	3E4059–28
C401	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 22 uuf ±10%; 500 vdcw; JAN type CM20B220K; spec JAN–C–5.	Crystal oscillator feedback.	3K2022021
C415	---	---	(*)	(*)	CAPACITOR, fixed: mica dielectric; 39 uuf ±5%; 500 vdcw; JAN type CM20B390; spec JAN–C–5. (Not in early C models.)	Tuning capacitor for L403, part of crystal oscillator frequency compensation.	3K2039032
C402, C406, C409, C410, C411	(*) (*) (*) (*) (*)	(*) (*) (*) (*) (*)	(*) (*) (*) (*) (*)	(*) (*) (*) (*) (*)	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K; spec JAN–C–5.	C402: Buffer grid coupling (V401). C406, Multiplier grid coupling (V402). C409, C410, and C411: Audio oscillator phasing (V403).	3K2010121

Ref symbol	Models A	B	C	D	Name of part and description	Function of part	Signal Corps stock No.
C403	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 510 uuf ±5%; 500 vdcw; JAN type CM20B511J; spec JAN–C–5.	Buffer amplifier (V401) to phase modulator (V402) grid coupling.	3K2051122
C408, C412	(*) (*)	(*) (*)	(*) (*)	(*) (*)	CAPACITOR, fixed: mica dielectric; 2000 uuf ±5%; 500 vdcw; JAN type CM30B202; type JAN–C–5.	C408: Multiplier plate circuit decoupling (V402). C412: Audio oscillator grid coupling (V403).	3K3020222
C404, C405, C413, C414, C416, C417	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	CAPACITOR, fixed: mica dielectric; 5100 uuf ±5%; 500 vdcw; JAN type CM35B512J; spec JAN–C–5.	C404: Phase modulator grid circuit decoupling (V402). C405: Audio oscillator output coupling (V403). C413: Audio oscillator screen grid bypass (V403). C414: Power supply r-f in B+ lead. (2000 uuf in early C models.) C416: Crystal oscillator plate blocking (V401). C417: Crystal oscillator plate circuit decoupling (V401).	3K3551222
C418	---	---	---	(*)	CAPACITOR, fixed: mica; 5600 uuf ±10%; 500 vdcw; JAN type CM35B562K. (5000 uuf in original set.)	B+ line decoupling	3K3556221
C407	(*)	(*)	(*)	(*)	CAPACITOR, variable: air dielectric; plate meshing type, single sect; 4 uuf min, 54 uuf max; SLC; all plating per U. S. Army spec 72–53, Table II, Type I, construction in accordance w/JAN–C–92.	Output tuning	3D9054V–4
	---	---	---	---	CLAMP, electrical: steel; 1″ lg x ⅞″ wd x ⅜″ h; mts by 2 holes, one on ea side of clamp; designed to accom all cables up to ½″; Amphenol part #79–CC4.	To hold power cable in place.	2Z2642.244
L401, L403	(*) ---	(*) ---	(*) (*)	(*) (*)	COIL, RF: choke; single universal wnd; 770 uh ±10% at 1000 cyc, 10 ma, 26 ohms DC resistance; 19⁄32″ lg x ½″ diam o/a; air core; phenolic form ¼″ OD x 19⁄32″ lg; mts by means of single #4–40 tapped hole thru axis of form; 2 tinned wire lead term; impregnated w/fungus resistant varnish; Hallicrafters part/dwg #51B1169; spec JAN–C–173.	L401: Crystal resonating inductor. L403: Part of crystal oscillator compensation circuit.	3C375–48
L402	---	(*)	(*)	(*)	COIL, RF: choke; 1 pie universal wnd; 120 uh, 99 turns per pie #34 single nylon E wire; ¾″ lg x 7⁄16″ diam less leads; dummy resistor coil form, Stackpole type #DR–1, .220″ OD x 3.4″ lg; mts by means of two 1½″ lg axial wire leads; 2 axial wire term; impregnated w/fungus resistant varnish; Hallicrafters part/dwg #55B185; spec JAN–C–173.	B+ r-f filter	3C362–2
T401	(*)	(*)	(*)	(*)	COIL, RF: RF transformer; 2 wnd single layer wnd; pri 1¼ turns #18 E copper wire, secd 2 turns #20 E copper wire; 1 3⁄16″ lg x 7⁄16″ diam o/a less term; solid lucite coil form ⅜″ diam x 1 3⁄16″ lg; mts by means of one .099″ diam axial hole; 4 radial wire lead term; Hallicrafters part/dwg #51A1170; fungus treated per spec JAN–C–173.	Output coupling transformer.	3F4325–32/C1

Ref symbol	Models A	B	C	D	Name of part and description	Function of part	Signal Corps stock No.
P401	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: Sig C Socket SO-239; single round female cont; straight type; 1 1/16″ lg x 1″ sq; cylindrical zinc shell, silver pl; mica filled bakelite insert; four .120″ diam mtg holes on 23/32″ sq mtg/c; Amphenol #83-1R; Hallicrafters part/dwg #10A056; Sig C dwg #SC-D-5850.	R-F OUTPUT connection	2Z8799-239
P402	(*)	(*)	(*)	(*)	CONNECTOR, plug: 8 round male cont; straight type; 1 1/4″ OD x 1 1/2″ lg less cont; cylindrical steel case, black japanned finish, fibre lined; molded black phenolic insert; cable clamp riveted on end to accom up 1/2″ diam cable; connector plugs into socket receiver chassis; incl cable clasp; Amphenol #PM8-11; Hallicrafters part/dwg #10A024.	Power cable plug	2Z7234-2
E404	---	---	---	---	INSULATOR, standoff: plastic rod, type LST-E-3, JAN spec P-79; brown; varnish per JAN spec JAN-C-173, Class I; cylindrical pillar shape; 13/16″ lg x 5/16″ wd; two #6-32 NC-2 tapped holes 1/4″ lg, one ea end; mtg hardware c/o two 6/32″ screws; Bellaire Electronics part #BT-T-5.	To hold coil form	3G350-148
E403	(*)	(*)	(*)	(*)	INSULATOR, standoff: round post shape; JAN type NS4W0105: spec JAN-I-8.	Component mounting	3G3501-05
	(*)	(*)	(*)	(*)	KNOB: round; black bakelite; for .251″ diam shaft; single #8-32 set screw; knob has pointer; 1 1/16″ diam x 13/32″ h; brass insert; shaft hole 11/32″ d; fine straight knurl; Harry Davies Mold part #1400 less set screw w/brass insert mtg; Hallicrafters part/dwg #15A213.	Tuning knob	2Z5821-4.1
	(*)	(*)	(*)	(*)	LINE, RF transmission: Army-Navy Cord CG-107/U (40″); uses Army-Navy Cable RG-8/U; 40″ lg excluding terminations; 43″ lg o/a; terminated at ea end in Sig C Plug PL-259-A; incls identification tag RL-A-825; Hallicrafters part/dwg #87B1765; per Sig C dwg #SG-B-22831.	Antenna coupling cable between receiver and test oscillator.	1F430-107.36
R404, R412	(*) (*)	(*) (*)	(*) ---	(*) ---	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; JAN type RC20BF103K; spec JAN-R-11.	R404: Buffer plate loads R412: Part of audio oscillator plate load.	3RC20BF103K
R403, R408, R418	(*) (*) ---	(*) (*) ---	(*) (*) (*)	(*) (*) (*)	RESISTOR, fixed; comp: 15,000 ohms ±10%; 1/2 w; JAN type RC20BF153K; spec JAN-R-11.	R403: Buffer amplifier (V401) grid bias. R408: Phase modulator (V402) cathode degenerative feedback. R418: Crystal oscillator (V401) band spreading.	3RC20BF153K
R412	---	---	(*)	(*)	RESISTOR, fixed: comp; 22,000 ohms ±10%; 1/2 w; JAN type RC20BF223K; spec JAN-R-11.	Part of audio oscillator (V403) plate load.	3RC20BF223K
R411	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 39,000 ohms ±10%; 1 w; JAN type RC20BF393K; spec JAN-R-11.	Part of audio oscillator plate load.	3RC20BF393K
R405	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1/2 w; JAN type RC20BF473K; spec JAN-R-11.	Phase modulator (V402) return.	3RC20BF473K
R402, R410	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1/2 w; JAN type RC20BF473K; spec JAN-R-11.	R402: Crystal oscillator (V401) plate circuit decoupling. R410: Phase modulator (V402) plate load.	3RC20BF473K
R417	---	---	(*)	---	RESISTOR, fixed: comp; 68,000 ohms ±10%; 1 w; JAN type RC30BF683K; spec JAN-R-11.	Audio oscillator (V403) screen dropping.	3RC30BF683K
R417	(*)	(*)	---	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K.	Audio oscillator (V403) screen dropping.	3RC30BF104K

6. Identification Table of Parts for Test Oscillator TS–32(*)/TRC–1—(Continued)

Ref symbol	Models A	B	C	D	Name of part and description	Function of part	Signal Corps stock No.
R407, R409	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K; spec JAN–R–11.	R407: Audio oscillator (V403) output isolation. R409: Multiplier (V402) grid bias.	3RC20BF104K
R406	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 270,000 ohms ±10%; ½ w; JAN type RC20BF274K; spec JAN–R–11.	Phase modulator (V402) grid leak bias and part of V403 plate load.	3RC20BF274K
R401	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 330,000 ohms ±10%; ½ w; JAN type RC20BF334K; spec JAN–R–11.	Crystal oscillator (V401) d-c grid return.	3RC20BF334K
R13, R14, R15	(*) (*) (*)	--- --- ---	--- --- ---	--- --- ---	RESISTOR, fixed: comp; 500,000 ohms ±10%; ½ w; JAN type RC20BF504K.	Audio oscillator (V404) phasing.	3RC20BF504K
R413, R414, R415	--- --- ---	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; JAN type RC20BF684K; spec JAN–R–11. (470,000 ohms in some procurements.)	Audio oscillator (V403) phasing.	3RC20BF684K
R416	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 5.1 meg ±5%; ½ w; JAN type RC20BF515J; spec JAN–R–11.	Audio oscillator (V403) d-c grid return.	3RC20BF515J
p/o P402	---	---	---	---	RING, retainer: spring steel; ring shape, not closed; 1.164″ ID x .118″ thk; Natl Lock Washer #XRC 346.	To hold plug, Amphenol #86–PM8–11, closed; fits tightly around plug.	2Z7858–203
YS401	(*)	(*)	(*)	(*)	SOCKET, crystal: mica-filled phenolic; .805″ lg x 47/64″ h x 5/16″ wd o/a; single .120″ diam hole, csk 7/32″ diam x 9/64″ d; silver pl beryllium copper cont are for 3/32″ diam pins, .486″ c to c; Cinch type #9816; Hallicrafters part/dwg #6A346.	Crystal socket for Y401	2Z8672.8
VS401, VS402, VS403	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	SOCKET, tube: octal; 1 piece saddle mtg; two .156″ diam mtg holes on 1½″ mtg/c, 1⅛″ diam chassis cutout required; round mica-filled phenolic body 17/64″ diam x ½″ h, excluding term; phosphor bronze silver pl cont; 4 ground lugs integral w/saddle; Cinch type #9886; Hallicrafters part dwg #6A317.	VS401: Socket for tube V401. VS402: Socket for tube V402. VS403: Socket for tube V403.	2Z8678.326
S401, S402	(*)	(*)	(*)	(*)	SWITCH, toggle: SPST; 3 amp, 250 v black phenolic body; 11/16″ lg x ½″ wd x 113/16″ h o/a; toggle handle ½″ lg; 2 solder lug term; 15/32″ –32 threading pushing 15/32″ lg; satin chrome finish on metal parts; Cutler-Hammer type #8280K16; Hallicrafters part dwg #60A378.	S401: CARRIER ON power switch. S402: MODULATION ON switch.	329863–13A
V401	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SN7GT; twin triode	Crystal oscillator-buffer amplifier tube.	2J6SN7GT
V402	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SL7GT; twin triode	Phase modulator-frequency multiplier tube.	2JSL7GT
V403	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SH7; pentode	Audio oscillator tube	2J6SH7

7. Identification Table of Parts for Radio Receiver R–19(*)/TRC–1

Note. See partial schematics for component values of unlettered model.

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	---	---	---	---	---	---	RECEIVER, radio: Army-Navy Radio Receiver R–19(*)/TRC–1; FM; 70–99.9 mc; 115 v AC, 50/60 cyc, 100 w; steel cabinet; 19⅛″ lg x 12¾″ d x 8″ h; 17 tube superheterodyne ckt.	Receives wide-band f-m signals.	2C4180–19

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
P/o FM101	(*)	(*)	(*)	(*)	(*)	(*)	BLADE, fan: propeller type, steel, black enamel finish; 4 blades w/hub; 4½″ dia x 23/32″ thk o/a; hub has tapped hole threaded #8–32 NC–2, bore .190″.	Blade for ventilation fan	3H4600–500.3
	(*)	(*)	(*)	(*)	(*)	(*)	BOARD, terminal: 16 brass tin pl turret type solder lug term; 2 rows of 8 term ea 1¼″ between row ctr, 7/16″ between term ctr; 4⅛″ lg x 1¾″ wd x 3/32″ thk, w/terms 7/16″ thk; two .156″ dia mtg holes on 3¾″ mtg/c.	Mounts resistors	3Z770–16.41
	---	---	---	---	---	(*)	BOARD, terminal: 3 brass tin pl turret type solder lug term; term form isosceles triangle ⅜″ base, 1¼″ h; 1 11/16″ lg x 1 7/32″ wd x 3/32″ thk, w/terms 7/16″ thk; two .136″ dia mtg holes on .875″ mtg/c.	Mounts resistors	3Z770–3.46
	(*)	(*)	(*)	(*)	(*)	(*)	BOARD, terminal: 46 brass tin turret type solder lug term; 2 rows 23 term ea, 1¼″ between row ctr, 5/16″ between term ctr; 7⅞″ lg x 1¾″ wd x 3/32″ thk, w/term 7/16″ thk; three .156″ dia holes spaced 2⅜″ and 3⅞″ apart.	Mounts resistors and capacitors.	3Z770–46.3
PC101	(*)	(*)	(*)	(*)	(*)	(*)	CABLE ASSEMBLY, power: Underwriters type S; two #16 AWG stranded cond stranding 65 x 34; 10 ft lg, excluding terminations; Hubbell #9754 2 cont male connector 1 end; other end stripped and tinned.	A-c input cord	3E7173–4
	(*)	(*)	(*)	(*)	(*)	(*)	CABLE ASSEMBLY, RF: Army-Navy Cord CG–107/U (40″) uses Army-Navy Radio Frequency Cable RG–8A/U; 40″ lg, excluding terminations; 43 3/16″ lg o/a; terminated at ea end in Sig C Plug PL–259–A; includes identification tag RL–A–825. (Cord CD–800 (40-inch) used with unlettered through E models.)	Antenna coupling cable between receiver and transmitter.	1F430–107.40
	(*)	(*)	(*)	(*)	(*)	(*)	CAP: die cast zinc, silver pl; cap 13/16″ dia x 7/16″ chain 4 9/16″ lg; cap tapped ⅝″ 24 thd, ¼″ d; cap marked "AMPHENOL 83–1AC"; end of chain to have clearance for #4 screw.	Dust and moisture cap for ANT. INPUT connector.	2Z1612.1
	(*)	(*)	(*)	(*)	(*)	(*)	CAP: metal; cap 1⅛″ OD x 7/16″ thk, chain 3½″ lg; cap tapped 1″ –20 thd ¼″ d; end link of chain to have clearance for #4 screw.	Dust and moisture cap and chain assembly for CONTROL CABLE input connector.	2Z1612.22
	(*)	(*)	(*)	(*)	(*)	(*)	CAP, cover: covers knob of Eby #14RC "Sargeant" Binding Post.	Covers knob of binding post.	3Z930–11
C151, C152, C167	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	CAPACITOR, fixed: ceramic dielectric; 2 uuf ±.25 uuf; 500 vdcw; JAN type CC21UK 020C; JAN spec JAN–C–20A.	C151: Oscillator coupling to grid of first mixer V103. C152: Coupling to grid of second mixer V105. C167: Oscillator coupling and voltage dropping to grid of V103.	3D9002–41
C139	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 24 uuf ±5%; 500 vdcw; JAN type CM20C240J; JAN spec JAN–C–5. (Original value, 25 uuf.)	Second limiter plate circuit coupling.	3K2024032
C136	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 100 uuf ±5%; 500 vdcw; JAN type CM20C101J; JAN spec JAN–C–5.	V108 plate and screen circuits r-f bypass.	3K2010132

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
C102, C103, C107, C114, C118, C123, C128, C133, C140, C141, C149	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K; JAN spec JAN–C–5.	C102: R-f coupling, V101 grid. C103: R-f bypass, V101 screen. C107: R-f bypass, V102 screen. C114: I-f coupling, V104 grid, part of T104. C118: I-f coupling, V105 grid, part of T105. C123: V106 grid leak bias and i-f grid circuit decoupling, part of T106. C128: I-f decoupling, V107 grid, part of T107. C133: V108 grid leak bias and i-f grid circuit decoupling, part of T108. C140 and C141: I-f bypass of discriminator load (V109). C149: R-f coupling, V112 grid.	3K2010121
C106, C110	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 200 uuf ±5%; 500 vdcw; JAN type CM20B201J; JAN spec JAN–C–5.	C106: V–102 grid leak bias and grid r-f circuit bypass. C110: V103 grid leak bias and r-f grid circuit bypass.	3K2020122
C105, C109	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 270 uuf ±10%; 500 vdcw; JAN type CM20B271K; JAN spec JAN–C–5. (250 uuf in unlettered through E models.)	C105: R-f bypass, V101 plate circuit. C109: R-f bypass, V102 plate circuit.	3K2027121
C169	---	---	---	---	---	(*)	CAPACITOR, fixed: mica dielectric; 510 uuf ±5%; 500 vdcw; JAN type CM20B511J; JAN spec JAN–C–5.	H-f peaking, discriminator output.	3K2051122
C111, C113, C115, C117, C119, C120, C146, C148, C150, C154, C161, C165, C166	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 1500 uuf ±10%; 500 vdcw; JAN type CM30B152K; JAN spec JAN–C–5.	C111: R-f bypass, V103 screen. C113: First mixer (V103) plate circuit decoupling. C115: R-f bypass, V104 screen. C117: I-f bypass, V104 plate circuit. C119: I-f bypass, V105 screen. C120: I-f bypass, V106 grid circuit. C146: R-f bypass, V111 screen. C148: R-f plate circuit bypass (V111). C150: R-f bypass, V121 screen.	3K3015221

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
								C154: R-f plate circuit bypass (V112). C161: R-f filter. B-plus line. C165 and C166: A-c line r-f filters.	
C124, C125, C130, C135, C144, C168	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	CAPACITOR, fixed: mica dielectric; 5100 uuf ±5%; 500 vdcw; JAN type CM35B512J; JAN spec JAN–C–5. (C124 and C125 are 5,000 uuf in unlettered through E models.)	C124 and C125: I-f bypass V106 screen. C130: I-f bypass V107 screen. C135: I-f bypass, V108 screen. C144: A-f coupling, V115 grid. C168: I-f bypass V107 screen.	3K3551222
C157A, C157B, C170	(*) (*) ---	(*) (*) ---	(*) (*) ---	(*) (*) ---	(*) (*) ---	(*) (*) (*)	CAPACITOR, fixed: mica dielectric; 10,000 uuf ±10%; 300 vdcw; JAN type CM35B 103K; JAN spec JAN–C–5. (C157B is marked C157 in the unlettered model; C157A and B are C157 (.02 uf) in the A through E models; C170 is not in all H models.)	C157A and C157B: A-f coupling, V113 and V114 grids. C170: L-f audio compensation, V115 grid circuit.	3K3510321
C129A, C129B, C129C, C159A, C159B, C159C	(*) (*) --- (*) (*) ---	(*) (*) --- (*) (*) ---	(*) (*) --- (*) (*) ---	(*) (*) --- (*) (*) ---	(*) (*) --- (*) (*) ---	(*) (*) (*) (*) (*) (*)	CAPACITOR, fixed: paper dielectric; JAN type CP53B5EF503V; 3 sect; .05-.05-.05 uf ±10%; 600 vdcw; JAN spec JAN–C–25. (C129A is C129 and C129B is C134, in unlettered through E models; C159A is C159 and C159B is C160 in unlettered through E models; C159 is 1,500 uuf in unlettered model and .1 uf in A through E models; C160 is .05 in A through E models.)	C129A: I-f meter bypass, position 3 in H model, positions 1 and 2 in the unlettered through E models. C129B: I-f meter bypass, positions 1 and 2 in H model, position 3 in the unlettered through E models. C129C: V115 grid, audio compensation. C159A and C159B: Squelch time constant (V115 grid). C159C: A-f filter (V115 plate).	3DA50–279
C142, C155, C156, C158	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	CAPACITOR, fixed: electrolytic dielectric; 25 uf; 50 vdcw; JAN type CE1C250G; JAN spec JAN–C–62. (C142 is .05 uf in the unlettered through E models.)	C142: A-f compensation (V115), meter bypass, positions 4 and 5. C155: Cathode audio bypass (V113). C156: Cathode bypass (V114). C158: Cathode audio bypass (V115).	3DB25–73
C121, C122, C126, C127, C131, C132, C137, C138	(*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*)	CAPACITOR, variable: air dielectric; plate meshing type, dual sect; 6–42 uuf per sect (3 to 37 uuf in original sets).	C121: Tuning second mixer plate (V105) (part of T106). C122: Tuning, grid circuit V106 (part of T106). C126: Tuning, plate circuit V106 (part of T107).	3D9042V–15

968874—52—22

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
								C127: Tuning, first limiter grid (V107) (part of T107). C131: Tuning, first limiter plate (V107) (part of T108). C132: Tuning, second limiter grid (V108) (part of T108). C137: Tuning, second limiter plate (V108) (part of T109). C138: Tuning, discriminator (V109) (part of T109).	
C162A	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: electrolytic; section of 20 uf; 350 vdcw; JAN type CE52C200P (on models A, B, C replaces C162- 10 uf; on models D, E replaces C162- 20 uf).	Power supply filter	3DB20–122
C162B	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: electrolytic; section of 20 uf; 350 vdcw; JAN type CE52C200P (on models A, B, C replaces C163–10 uf; on models D, E replaces C163–20 uf).	Power supply filter	3DB20–122
C164A, C164B	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	CAPACITOR, fixed: electrolytic; 20–20 uf; 350 vdcw; JAN type CE52C200P (on models A, B, C, replaces C164–20 uf; on models D, E replaces C164–40 uf).	Power supply filter	3DB20–122
C101, C104, C108, C112, C116, C147, C153	(*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*)	CAPACITOR, variable: air dielectric; plate meshing type, single sect; 3 uuf min, 54 uuf max ±7% of max.	C101: Tuning, antenna circuit. C104: Tuning, T102 primary (plate circuit V101). C108: Tuning, T103 primary (plate circuit V102). C112: Tuning, first mixer (V103) (part of T104). C116: Tuning, h-f, i-f amplifier (V104) (part of T105). C147: Tuning, crystal oscillator multiplier, plate circuit V111 (part of T110). C153: Tuning oscillator amplifier (V112) (part of T111).	3D9054V
Fig. 12	(*)	(*)	(*)	(*)	(*)	(*)	CASE: Army-Navy Case CY–18/TRC–1; plywood, olive drab finish; 22½″ lg x 17¾″ h x 16″ d o/a; interior fitted w/2 slide type vibration mounts, perforated metal tray and protective canvas canopy; bottom of case fitted w/drawer 18″ lg x 3″ h x 15″ d w/2 partitions; 1 folding type handle located on ea end; lid has metal support arm, lid held closed by 6 metal strike fasteners.	Holds receiver	2Z1891–18

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	(*)	CLAMP: phosphor bronze; cadmium pl	For holding the two plug-in type capacitors in sockets.	2Z2642.343
	(*)	(*)	(*)	(*)	(*)	(*)	CLEANER ELEMENT, air: screen type; zinc pl steel wire; steel container; $8\tfrac{11}{16}$″ lg x $4\tfrac{5}{8}$″ wd x $\tfrac{15}{32}$″ thk o/a. (Original unlettered through E models used a fiberglass (non-replaceable) filter element.)	Filter air	6Z3856–67.1
T104	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF; freq range fully assembled 32.3–47.7 mc; single wnd, space wnd; rectangular aluminum shield can.	V103 to V104 coupling circuit.	2C4180–19/C4
T105	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: freq range fully assembled, 32.3–47.7 mc; single wnd, space wnd, rectangular aluminum shield can.	V104 to V105 coupling circuit.	2Z9643.101
T111	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: single wnd, space wnd; rectangular aluminum shield can.	Oscillator amplifier load network.	2C4180–19/C5
P107	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: 2 banana plug cont; straight type.	Fan connector	2Z3022–37
P108	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: 2 round female cont; straight banana jack type.	Fan connector	2Z3063–33
P101	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: Sig C Socket SO–239; single round female cont; straight type.	ANTENNA INPUT plug	2Z8799–239
P103	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: seven #20 round female cont pol; straight type.	CONTROL CABLE connector.	2Z8677.49
P109	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, plug: 2 flat parallel blades; straight type.	A-C LINE connector	6Z1735.12
	(*)	(*)	(*)	(*)	(*)	(*)	COVER, relay: dust	Cover for relay	2Z3352.80
	(*)	(*)	(*)	(*)	(*)	—	DIAL, control: movable scale type; 70 to 100 left to right.	Frequency dial for i-f and oscillator transformers.	2Z5850–43
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: Dzus button type AJ5–35; shaft $\tfrac{5}{16}$″ dia undercut .125″ below head, .35″ from head to cam.	—	6Z3809–9.1
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: wing type; head $1\tfrac{1}{8}$″ lg x $\tfrac{7}{16}$″ h x .062″ thk, shaft $\tfrac{5}{16}$″ dia undercut .125″ below head; .350″ from head to cam.	—	6Z3809–3.1
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: wing type; wing $1\tfrac{1}{4}$″ lg x $\tfrac{7}{16}$″ h, shank $\tfrac{3}{8}$″ dia, .400″ lg under head to cam slot.	—	6Z3809–14
T114, T117	(*)	(*)	(*)	(*)	(*)	(*)	FILTER, low pass: attenuation 30 db or more at 3,000 cyc and higher.	Low-pass audio filters	3Z1893–22
F101	(*)	(*)	(*)	(*)	(*)	(*)	FUSE, cartridge: 2 amp	LINE FUSE	3Z1927
FS101	(*)	(*)	(*)	(*)	(*)	(*)	FUSEHOLDER: extractor post type; for single 3 AG cartridge fuse; Buss #HKP–L.	LINE FUSE holder	3Z3285–2
	(*)	(*)	(*)	(*)	(*)	(*)	GASKET: meter; black rubber; 4 holes; round, $2\tfrac{11}{16}$″ OD x $2\tfrac{3}{16}$″ ID x $\tfrac{1}{8}$″ thk.	Gasket between meter and front panel.	2Z4867.396
	(*)	(*)	(*)	(*)	(*)	(*)	GROMMET: plastic; fits $\tfrac{5}{8}$″ hole	Line cord protection	6Z4920–27
	(*)	(*)	(*)	(*)	(*)	(*)	INSULATOR, standoff: cylindrical; 5 used; JAN type NS5W0106; JAN spec JAN–I–8.	Component mountings	3G3501–06.2
	(*)	(*)	(*)	(*)	(*)	(*)	KNOB: w/pointer; black bakelite; for $\tfrac{1}{4}$″ dia shaft; single #8–32 set screw; $1\tfrac{1}{4}$″ lg x $\tfrac{5}{8}$″ wd x $\tfrac{5}{8}$″ h o/a.	METER SWITCH knob and SPEAKER VOLUME knob.	2Z5848
	(*)	(*)	(*)	(*)	(*)	—	KNOB: round; black bakelite; $\tfrac{3}{16}$″ dia shaft; marked "T–102 1st RF."	Tuning control for first r.f.	2Z5850–44
	(*)	(*)	(*)	(*)	(*)	—	KNOB: round; black bakelite; $\tfrac{3}{16}$″ dia shaft; marked "T–104 1st mix."	Tuning control for first mixer.	2Z5850–42
	(*)	(*)	(*)	(*)	(*)	—	KNOB: round; black bakelite; $\tfrac{3}{16}$″ dia shaft; marked "T–105 1st IF."	Tuning control for first i.f.	2Z5850–45

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16" dia shaft; marked "T–110 OSC AMP."	Tuning control for oscillator.	2Z5786–63
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16" dia shaft; marked "T–111 OSC AMP."	Tuning control for oscillator amplifier.	2Z5786–62
PL101, PL102	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	LAMP, incandescent: Sig C Lamp LM–52; 6–8 v .15 amp; bulb T–3¼ clear; 1 13/16" lg o/a; miniature bayonet base.	PL101: Carrier on indicator. PL102: Power on indicator.	2Z5952
	(*)	(*)	(*)	(*)	(*)	(*)	LENS, indicator light: green	POWER ON indicator	2Z5891–52
	(*)	(*)	(*)	(*)	(*)	(*)	LENS, indicator light: red	CARRIER ON indicator	2Z5891–53
	(*)	(*)	(*)	(*)	(*)	(*)	LIGHT, indicator: w/o lens; for miniature bayonet base T 3¼ bulb.	Indicator bulb mount	2Z5883–105
M101	---	(*)	---	(*)	(*)	(*)	METER, multi-scale: DC; 0–100 ua; round black plastic flush mtg case.	Indicating meter for circuit operations.	3F871–9
M101	(*)	---	(*)	---	---	---	METER, multi-scale: DC, 0–100 ma w/red line marked 115 v −8 to +6 db.	Indicating meter for circuit operations.	3F871–9.1
P/o FM101	(*)	(*)	(*)	(*)	(*)	(*)	MOTOR, AC: shaded pole type; .005 hp, 2700 rmp; open frame; 115 v AC, 60 cyc, single ph, .29 amp.	Blower motor	3H3000–42
	(*)	(*)	(*)	(*)	(*)	(*)	MOUNT: vibration; sq mtg; 1 1/16" h x 2 3/8" sq		2Z8401–5PH12
P104, P105	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	POST, binding: screw type	Audio RECEIVER OUTPUT terminals.	3Z286
CH101, CH102	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	REACTOR: filter choke; 1 sect; 5 h, .050 amp; 212 ohm DC resistance; 1000 v RMS test; HS metal case. (Values in original sets vary from 4.7 to 6 h.)	B+ filter choke	3C323–56C
RE101	(*)	(*)	(*)	(*)	(*)	(*)	RECTIFIER, metallic: copper oxide; input 5 v AC, 60 cyc; output 5 ma DC average; rectangular.	Meter rectifier	3H4702–4
RL101	(*)	(*)	(*)	(*)	(*)	(*)	RELAY, armature: cont arrangement 1A1C; 175 w but not over 4 amp.	Squelch circuit control	2Z7589–133
R166	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: composition; 51 ohms ±5%; ½ w; JAN type RC20BF510J; JAN spec JAN–R–11.	Parasitic suppressor, V112 grid.	3RC20BF510J
R123	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 200 ohms ±5%; ½ w; JAN type RC20BF201J; JAN spec JAN–R–11.	Meter shunt (second limiter grid, V108).	3RC20BF201J
R119	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 510 ohms ±5%; ½ w; JAN type RC20BF511J; JAN spec JAN–R–11.	Meter shunt (first limiter grid, V107).	3RC20BF511J
R160	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 2000 ohms ±5%; ½ w; JAN type RC20BF202J; JAN spec JAN–R–11.	Meter multiplier (S106, position 2).	3RC20BF202J
R126	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 20,000 ohms ±5%; ½ w; JAN type RC20BF203J; JAN spec JAN–R–11.	Part of discriminator circuit (V109).	3RC20BF203J
R167	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 22,000 ohms ±5%; ½ w; JAN type RC20BF223J; JAN spec JAN–R–11.	H-f compensation, V115 grid.	3RC20BF223J
R114, R118, R122, R127, R128, R135	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K; JAN spec JAN–R–11.	R114: Grid bias, V106. R118: Grid bias, V107. R122: Grid bias, V108. R127 and R128: Discriminator loads (V109). R135: Grid bias (V111).	3RC20BF104K
R111, R161	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K; JAN spec JAN–R–11.	R111: Grid bias (V105). R161: Part of squelch rectifier (V110) input isolation circuit.	3RC20BF154K

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R137	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 240,000 ohms ±5%; ½ w; JAN type RC20BF244J; JAN spec JAN–R–11. (250K in unlettered through E models.)	Bias resistor, V112 grid	3RC20BF244J
R117	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 510,000 ohms ±5%; ½ w; JAN type RC20BF514J; JAN spec JAN–R–11. (500K in unlettered through E models.)	Squelch isolation	3RC20BF514J
R101, R103	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K; JAN spec JAN–R–11.	R101: Bias resistor, V101 grid. R103: Bias resistor, V102 grid.	3RC20BF105K
R105, R108, R111, R134	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) --- (*)	RESISTOR, fixed: comp; 5.1 meg ±5%; ½ w; JAN type RC20BF515J; JAN spec JAN–R–11. (5 megohms in the unlettered through E models.)	R105: Bias resistor (V103) R108: Bias resistor (V104) R111: V105 grid bias R134: Squelch rectifier resistor (V110).	3RC20BF515J
R139, R154	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 15 ohms ±10%; 1 w; JAN type RC30BF150K; JAN spec JAN–R–11.	R139: CARRIER ON pilot light voltage-dropping resistor. R154: POWER ON pilot light voltage-dropping resistor.	3RC30BF150K
R144	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: comp; 510 ohms ±5%; 1 w; JAN type RC30BF511J; JAN spec JAN–R–11. (500 ohms in D and E models.)	Cathode bias resistor (V114).	3RC30BF511J
R142, R144, R155	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) --- ---	(*) --- ---	(*) --- ---	RESISTOR, fixed: comp; 1000 ohms ±10%; 1 w; JAN type RC30BF102K; JAN spec JAN–R–11.	R142: Cathode bias resistor (V113). R144: V114 cathode bias R155: Limits headset current.	3RC30BF102K
R157	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: comp; 1500 ohms ±10%; 1 w; JAN type RC30BF152K; JAN spec JAN–R–11.	Part of meter multiplier, position 6.	3RC30BF152K
R151, R163	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 2000 ohms ±5%; 1 w; JAN type RC30BF202J; JAN spec JAN–R–11.	R151: Cathode bias resistor, V115. R163: Part of bias circuit (V114) when SQUELCH is in OFF position.	3RC30BF202J
R141	(*)	(*)	(*)	---	---	---	RESISTOR, fixed: comp; 7500 ohms ±5%; 1 w; JAN type RC30BF752J.	Part of cathode bias circuit (V113, relay amplifier section).	3RC30BF752J
R157, R158, R159	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	--- (*) (*)	--- (*) (*)	--- (*) (*)	RESISTOR, fixed: comp; 3000 ohms ±5%; 1 w; JAN type RC30BF302J; JAN spec JAN–R–11.	R157: Part of meter multiplier position 6 of S106. R158 and R159: Meter bridge resistors position 6 of S106.	3RC30BF302J
R131	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 5100 ohms ±5%; 1 w; JAN type RC30BF512J; JAN spec JAN–R–11. (5000 in unlettered through E models.)	Meter shunt (discriminator circuit), positions 4 and 5 of S106.	3RC30BF512J

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R107, R110, R113, R130, R141, R168	(*) (*) (*) (*) --- ---	(*) (*) (*) (*) --- ---	(*) (*) (*) (*) --- ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) (*)	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; JAN type RC30BF103K; JAN spec JAN–R–11.	R107: Decoupling, plate circuit (V103). R110: Decoupling, plate circuit (V104). R113: Decoupling, plate circuit (V105). R130: Part of discriminator output voltage divider. R141: Part of cathode bias circuit (V113, relay amplifier section). R168: L-f compensation, V115 grid.	3RC30BF103K
R150	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 20,000 ohms ±5%; 1 w; JAN type RC30BF203J; JAN spec JAN–R–11.	Part of B+ voltage divider circuit, V115 plate, squelch section.	3RC30BF203J
R149	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 39,000 ohms ±10%; 1 w; JAN type RC30BF393K; JAN spec JAN–R–11. (40K in unlettered through E models.)	Part of B+ voltage divider circuit, V115 plate, squelch section.	3RC30BF393K
R109	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 75,000 ohms ±5%; 1 w; JAN type RC30BF753J; JAN spec JAN–R–11.	Screen dropping and voltage division (V104).	3RC30BF753J
R102, R104, R112, R129, R136, R138	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K; JAN spec JAN–R–11.	R102: Screen dropping (V101). R104: Screen dropping (V102). R112: Screen dropping (V105). R129: Part of audio voltage compensation network, V115 grid. R136: Screen dropping (V111). R138: Screen dropping (V112).	3RC30BF104K
R146, R148	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: composition; 240,000 ohms ±5%; 1 w; JAN type RC30BF244J; JAN spec JAN–R–11. (250K in unlettered through E models.)	R146: A-f amplifier plate load (V115). R148: Squelch amplifier plate load (V115).	3RC30BF244J
R106	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: composition; 510,000 ohms ±5%; 1 w; JAN type RC30BF514J; JAN spec JAN–R–11. (500K in unlettered through E models.)	Screen voltage dropping (V103).	3RC30BF514J
R156	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: composition; 620,000 ohms ±5%; 1 w; JAN type RC30BF624J; JAN spec JAN–R–11. (640K in D and E models.)	Part of meter multiplier for S106, position 6 and S105 pushed for line check.	3RC30BF624J
R147	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: composition; 1 meg ±10%; 1 w; JAN type RC30BF105K; JAN spec JAN–R–11.	L-f compensation, a-f grid circuit (V115).	3RC30BF105K
R115, R120, R124	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	RESISTOR, fixed: Composition; 24,000 ohms ±5%; 2 w; JAN type RC42BF243J; JAN spec JAN–R–11. (R115 replaces R115 and R116, R120 replaces R120 and R121, R124 replaces R124 and R125 (each 50K) in the unlettered through E models).	R115: Screen dropping (V106). R120: Screen dropping (V107). R124: Screen dropping (V108).	3RC42BF243J

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R161	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K. (500K in A through E models.)	Part of squelch rectifier (V110) input voltage divider.	3RC20BF474K
R140	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 39,000 ohms ±5%; 2 w; JAN type RC42BF393J; JAN spec JAN–R–11. (40K in unlettered through E models.)	Part of cathode bias circuit, V113, squelch section.	3RC42BF393J
R164	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: WW; 6.3 ohms; ±5%; 10 w; JAN type RW31F6R3; JAN spec JAN-R-26A. (6 ohms in D and E models.)	Audio output load when S101 is in OFF position.	3RW11108
R165	---	---	---	(*)	(*)	(*)	RESISTOR, variable: WW; 2000 ohms ±10%; 2 w.	Meter multiplier adjustment potentiometer (position 6 of S106).	3Z7320–47
R162	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, variable: comp; 100,000 ohms ±20%; 2 w at 500 v; JAN type RV4AUSA 1040.	Squelch control potentiometer (V104 screen circuit).	3RV51033
R143	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, variable: comp; 250,000 ohms ±20%; ½ w at 500 v; JAN type RV3AUSA 245B.	AUDIO GAIN control potentiometer.	3RV52521
R145	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, variable: comp; 250,000 ohms ±20%; ½ w at 500 v; JAN type RV3AUF K254B.	SPEAKER VOLUME control potentiometer (V114).	3RV52502
YS101	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, crystal: Navy type 49951.	Crystal socket for Y101.	2Z8672.8
P106,	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, tube: octal; 1 piece saddle mtg; JAN type TSB8T101.	P106: Socket for test oscillator plug.	2Z8678.326
VS101 thru	(*)	(*)	(*)	(*)	(*)	(*)		VS101: Socket for tube V101.	
VS117,	(*)	(*)	(*)	(*)	(*)	---			
X101,	(*)	(*)	(*)	(*)	(*)	(*)		VS102: Socket for tube V102.	
X102	(*)	(*)	(*)	(*)	(*)	(*)		VS103: Socket for tube V103.	
								VS104: Socket for tube V104.	
								VS105: Socket for tube V105.	
								VS106: Socket for tube V106.	
								VS107: Socket for tube V107.	
								VS108: Socket for tube V108.	
								VS109: Socket for tube V109.	
								VS110: Socket for tube V110.	
								VS111: Socket for tube V111.	
								VS112: Socket for tube V112.	
								VS113: Socket for tube V113.	
								VS114: Socket for tube V114.	
								VS115: Socket for tube V115.	
								VS116: Socket for tube V116.	

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
								VS117: Socket for tube V117. X101: Socket for mounting C162 (or C162A and B). X102: Socket for mounting C163 (or C164A and B).	
SP101	(*)	(*)	(*)	(*)	(*)	(*)	SPEAKER, dynamic: 5″ dia cone; PM field.	Audio reproducer (speaker).	6C35–15.1
	(*)	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; Dzus type; spring-lock; cadmium pl music wire; 1½″ lg x ½″ wd x 7/32″ h o/a.	Cover fastener springs.	6ZK3809–13
	(*)	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; lock Dzus type fasteners; 1½″ lg x ½″ wd x .200″ thk at ends.	Locks Dzus type fasteners.	2Z8879–38
S106	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, rotary: 2 pole 6 position; single sect.	METER SWITCH circuit selector.	3Z8314.1
TD101	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, thermostatic: SPST; opens at 75°F ±3 deg, closes at 85°F ±3 deg.	Fan motor thermal control switch.	2Z9486–1
S101, S102	--- ---	--- ---	--- ---	(*) (*)	(*) (*)	(*) (*)	SWITCH, toggle: SPDT; JAN type ST42D; spec JAN–S–23.	S101: SPEAKER ON-OFF switch. S102: SQUELCH ON-OFF switch.	3Z9863–42D
S101, S102, S103	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	--- --- (*)	--- --- (*)	--- --- (*)	SWITCH, toggle: SPST; JAN type ST42A w/JAN type STRO1; spec JAN–S–23.	S101: SPEAKER ON-OFF switch. S102: SQUELCH ON-OFF switch. S103: A-c LINE ON-OFF switch.	3Z9863.42A
S104	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, toggle: DPDT; JAN type ST22N; spec JAN–S–23.	SINGLE CHANNEL MULTICHANNEL selector switch.	3Z9849.135
S105	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, toggle: DPDT; JAN type ST52R; spec JAN–S–23.	Line check switch.	3Z9863–52R
S107	---	---	---	(*)	(*)	(*)	SWITCH, toggle: SPST; JAN type ST42A; spec JAN–S–23.	MUTE ON-OFF switch.	3Z9863.42A
T112	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: plate coupling type; pri 9000 ohms impedance, secd 500 ohms impedance CT; HS steel case; 250–15,000 cyc ±1 db.	Output, V113 to line.	2Z9632.173
T113	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: line type; pri 500 ohms impedance; secd 8 ohms impedance; HS steel case; 200–3000 cyc ±1 db.	Output, T114 to speaker.	2Z9632.345
T115	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: plate coupling type; pri 9000 ohms impedance, secd 500 ohms impedance, pri current 18.5 ma DC; HS steel case; 300–3000 cyc.	Output, V114 to T114.	2Z9632.427
T106	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, IF: 5 mc; interstage, 1st LF IF; shielded, rectangular aluminum shield can.	V105 to V106 coupling.	2Z9643.59
T107	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, IF: 5 mc; 1st limiter input; rectangular aluminum shield can.	V106 to V107 coupling.	2C4180–19/T3
T108	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, IF: 5 mc; 2d limiter input; rectangular aluminum shield can.	V107 to V108 coupling.	2C4180–19/T1
T109	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, IF: 5 mc; rectangular aluminum shield can.	Discriminator network.	2C4180–19/T2
T116	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, power: input 115 v AC, 50/60 cycle, single ph; 2 output wnd; secd	Plate and filament power supply transformer.	2Z9613.388

7. Identification Table of Parts for Radio Receiver R–19(*)/TRC–1—(Continued)

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
							#1, 488 v at .095 amp CT, secd #2, 6.3 v at 6.2 amp; breakdown voltage 1750 v; no coolant; HS metal case.		
T101	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, RF: 2 wnd, space wnd; unshielded.	Antenna input transformer.	3C302K–1
T102	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, RF: pri and secd wnd on separate forms; pri and secd linked by coupling loop; unshielded.	First r-f transformer.	2C4180–19/C1
T103	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, RF: pri and secd wnd on separate forms, pri and secd linked by coupling loop; unshielded.	Second r-f coil, input to first mixer.	2C4180–19/C3
T110	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, RF: 37–54 mc; 2 wnd, 1 single layer wnd, 1 space wnd; rectangular aluminum shield can.	Crystal oscillator load and frequency multiplier coil.	2C4180–19/C2
V101,	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6AC7; pentode.	V101: First r-f amplifier.	2J6AC7
V105,	(*)	(*)	(*)	(*)	(*)	(*)		V105: Second mixer.	
V108	(*)	(*)	(*)	(*)	(*)	(*)		V108: Second limiter.	
V109,	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6H6; twin diode.	V109: Discriminator.	2J6H6
V110	(*)	(*)	(*)	(*)	(*)	(*)		V110: Squelch rectifier.	
V102,	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SH7; pentode.	V102: Second r-f amplifier.	2J6SH7
V103,	(*)	(*)	(*)	(*)	(*)	(*)		V103: First mixer.	
V104,	(*)	(*)	(*)	(*)	(*)	(*)		V104: H-f, i-f amplifier.	
V106,	(*)	(*)	(*)	(*)	(*)	(*)		V106: L-f, i-f amplifier.	
V107,	(*)	(*)	(*)	(*)	(*)	(*)		V107: First limiter.	
V111,	(*)	(*)	(*)	(*)	(*)	(*)		V111: Crystal oscillator and multiplier.	
V112	(*)	(*)	(*)	(*)	(*)	(*)		V112: Oscillator amplifier.	
V115	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SL7GT; twin triode.	First a-f amplifier and squelch amplifier.	2J6SL7GT
V113	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6SN7GT; twin triode.	Audio and relay amplifier.	2J6SN7GT
V114	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6V6GT/G; beam power amplifier.	Speaker amplifier.	2J6V6GT/G
V116,	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN–6X5GT/G; full-wave rectifier.	Power supply rectifiers.	2J6X5GT/G
V117	(*)	(*)	(*)	(*)	(*)	(*)			

8. Identification Table of Parts for Radio Transitter T–14(*)/TRC–1

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
							TRANSMITTER, radio: Army-Navy Radio Transmitter T–14(*)/TRC–1; FM; 70–99.9 mc; output 40 w max, 10 w on low power; input 115 v AC, 50/60 cyc, 250 w; mtd in steel cabinet; 19⅛″ lg x 12¾″ d x 10¾″ h; xtal-controlled; accessories incl 1 ea Case CY–17()/TRC–1; 2 ea air filter spare lamps, fuses, and tubes; voice or multichannel tp, tg or facsimile type of transmission, phase shift method of FM.	Transmits wide-band f-m signals.	2C900–14
R4	(*)	(*)	(*)	(*)	(*)	(*)	ATTENUATOR, variable: unbalanced pot; carbon 100,000 ohms ±5%; aluminum case 1¾″ diam x 2″ d, flattened shaft ¾″ lg x ¼″ diam; O–12 db attenuation; 13 step attenuation, linear taper; 3 solder lug term; two #6–32 tapped mtg holes on 1⅜″ ctr; control has detent stop; Davenco #CP800.	Compensator for line losses to maintain proper audio level.	2Z395.25

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
p/o FM1	(*)	(*)	(*)	(*)	(*)	(*)	BLADE, fan: propeller type; steel, black enamel finish; 4 blades w/hub; 4½″ diam x 23⁄32″ thk o/a; hub has tapped hole threaded #8–32 NC–2, bore .190″; Torrington #0–45 27–4; Hallicrafters part/dwg #80B102.	Blade for ventilation fan.	3H4600–500–3
A1 thru A4	(*)	(*)	(*)	(*)	(*)	(*)	BLOCK, protector: for indoor or outdoor use; 1¼″ lg x ⅜″ wd x 9⁄32″ h o/a; ceramic body w/carbon insert ⅜″ lg x 13⁄64″ h; 1 carbon brush term; WECo #27; Hallicrafters part/-dwg #10A353.	Part of lightning arrestors.	4E927
A1 thru A4	(*)	(*)	(*)	(*)	(*)	(*)	BLOCK, protector: carbon block; 1¼″ lg x 25⁄64″ wd x 5⁄32″ h o/a; WECo #26; Hallicrafters part/dwg #10A352.	Part of lightning arrestors.	4E926
p/o P10	(*)	(*)	(*)	(*)	(*)	(*)	BLOCK, contact: coated w/fungus resistant lacquer; rectangular block; 113⁄16″ lg x ½″ wd x ¼″ thk; two .147″ diam holes on 17⁄16″ mtg-/c; contains two #6–32 tapped holes, ⅝″ between ctr; per Hallicrafters part/dwg #8A996; black plastic type LTS–E–2 per spec JAN–C–173.	Mounting for blower motor power input.	2Z736–72
p/o P11	(*)	(*)	(*)	(*)	(*)	(*)	BLOCK, contact: coated w/fungus proof lacquer rectangular block; 1¼″ lg x 1⅛″ wd x ⅝″ thk; two #10–32 tapped holes 7⁄16″ d on ¾″ mtg/c; contains 2 holes for banana jack mounting 9⁄32″ diam, ctb ½″ diam x 5⁄16″ d, ⅝″ between ctr; per Hallicrafters part/dwg #8A993; black plastic LTS–E–2 per spec JAN–P–13, lacquer per spec JAN–C–173.	Banana jack mounting for blower motor power input.	2Z736–71
	(*)	(*)	(*)	(*)	(*)	(*)	BOARD, terminal: 12 turret solder lug term tin pl brass; 2 rows of 6 ea term opposed w/1¼″ between rows, term spaced ½″ apart, except 2nd from end on bottom row located on lg counterline of board; natural plastic, type LTS–E–5; 321⁄32″ lg x 1¾″ wd x 3⁄32″ thk, w/term ¾″ thk; two .156″ diam mtg holes on 39⁄32″ mtg/c; Hallicrafters part/dwg #88B618.	Mounts capacitors and resistors.	3Z770–12.78
	(*)	(*)	(*)	(*)	(*)	(*)	BOARD, terminal: 2 turret brass tin pl solder lug term; 15⁄16″ between term; natural plastic, type LTS–E–5; 3½″ lg x 1½″ wd x 3⁄32″ thk, w/term ½″ thk; two .196″ diam mtg holes on 113⁄32″ mtg/c; board has one 25⁄64″ diam hole in corner, ckt symbols stamped on board; Hallicrafters part/dwg #88B635.	Mounts resistors.	3Z770–2.77
PC1	(*)	(*)	(*)	(*)	(*)	(*)	CABLE ASSEMBLY, power: Underwriters type S; two #16 AWS stranded cond stranding 65 X 34; 10 ft lg, excluding terminations; Hubbell #9754 two cont male connector at 1 end, other end stripped and tinned; U. S. Rubber per Hallicrafters part/dwg#87B1701.	A-c input cord.	3E7173–4
	(*)	(*)	(*)	(*)	(*)	(*)	CAP: w/chain assembly; die case zinc, silver pl; cap 11⁄16″ diam x 7⁄16″ h chain 49⁄16″ lg; cap tapped ⅝″ —24 thread, ¼″ d; cap marked ″AMPHENOL 83–1AC″; end of chain has clearance for #4 screw; Hallicrafters part/-dwg #76B653.	Dust and moisture cap, ANTENNA and RECEIVER connectors.	2Z1612.1
	(*)	(*)	(*)	(*)	(*)	(*)	CAP: w/chain assembly; metal; cap 1⅛″ diam x 7⁄16″ h, chain 3½″ lg; cap tapped 1″ –20 thread ¼″ d; end link of chain has clearance for #4 screw; Amphenol #9760–16.	Dust and moisture cap, control cable connector.	2Z1612.22

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	(*)	CAP: jack cap; aluminum, olive drab finish; nearly round w/hinge at 1 end; 13⁄16″ lg x 23⁄32″ WDX 7⁄32″ thk o/a; mts by single hole w/clearance for 3⁄8″ diam bushing; furnished w/felt padding; Croname #A–22227.	Caps for microphone and and headset jacks.	3Z930–11
C63, C64	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	CAPACITOR, fixed: mica dielectric; 10 uuf ±10%; 500 vdcw; JAN type CM20B100K; JAN spec JAN–C–5.	Low-pass filter T11 tuning capacitors.	3K2010021
C1	---	---	---	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 22 uuf ±10%; 500 vdcw; JAN type CM20C220K; JAN spec JAN–C–5.	Crystal feedback.	3K2022031
C65	---	---	---	---	---	(*)	CAPACITOR, fixed: mica dielectric; 22 uuf ±10%; 500 vdcw; JAN type CM20B220K; JAN spec JAN–C–5.	Shunt capacitor, in low-pass.	3K2022032
C42	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 24 uuf ±5%; 2500 vdcw; JAN type CM55B240J; JAN spec JAN–C–5. (25 uuf in unlettered through E models.)	Antenna coupling capacitor.	3K5521022
C1, C54	(*) ---	(*) ---	(*) ---	--- (*)	--- (*)	--- (*)	CAPACITOR, fixed: mica dielectric; 39 uuf ±10%; 500 vdcw: JAN type CM20B390K; JAN spec JAN–C–5. (C1 is 40 uuf in original unlettered through C models.)	C1: Crystal feedback. C54: Part of fixed-tuned resonant plate load, V1.	3K2039021
C8	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 51 uuf ±5%; 500 vdcw; JAN type CM20C510J; JAN spec JAN–C–5. (50 uuf in D and E models.)	Grid coupling to V3	3K2051032
C5, C13, C18, C23, C28, C57	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) ---	(*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*)	(*) (*) (*) --- --- ---	CAPACITOR, fixed: mica dielectric; 100 uuf ±10%; 500 vdcw; JAN type CM20B101K; JAN spec JAN–C–5.	C5: Grid coupling to oscillator amplifier V2. C13: Grid coupling to V5 C18: Grid coupling to V6. C23: Coupling from V6 to V7. C28: Coupling from V7 to V8. C57: Grid leak capacitor for V4.	3K2010121
C75	---	---	---	---	---	(*)	CAPACITOR, fixed: mica dielectric; 200 uuf ±5%; 500 vdcw; JAN type CM20B201J; JAN spec JAN–C–5.	Plate circuit coupling to plate load, V8.	3K2020122
C2	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 470 uuf ±10%; 500 vdcw; JAN type CM20B471K; JAN spec JAN–C–5. (500 uuf in unlettered through E models.)	Plate circuit r-f bypass, audio amplifier V1.	3K2047121
C7, C9, C10, C14, C15, C16, C19, C20, C21, C24, C25, C26, C30, C31, C36,	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	(*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*) (*)	CAPACITOR, fixed: mica dielectric; 1500 uuf ±10%; 500 vdcw; JAN type CM30B152K; JAN spec JAN–C–5.	C7: Screen bypass, oscillator amplifier V2. C9: Grid coupling to tripler V4. C10: Screen bypass, tripler V4. C14: Plate circuit bypass, tripler V4. C15: Meter r-f bypass, position 1 of S3. C16: Screen bypass, V5. C19: Plate circuit bypass, V5. C20: Meter r-f bypass, position 2 of S3.	3K3015221

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
C37,	(*)	(*)	(*)	(*)	(*)	(*)		C21: Screen bypass, V6. C24: Plate circuit bypass, V6. C25: Meter r-f bypass, position 3 of S3. C26: Screen bypass, V7. C30: Meter r-f bypass, position 4 of S3. C31: Screen bypass, V8. C36 and C37: Grid leak capacitors power amplifier V9.	
C43,	(*)	(*)	(*)	(*)	(*)	(*)		C43: Meter r-f bypass, all positions of S3. C48 and C49: A-c line r-f bypass, capacitors. C58: Plate decoupling for V3. C61: Grid circuit bypass, V7. C62: Grid circuit bypass, V8. C74: V3 plate (pin 5) r-f bypass.	
C48,	(*)	(*)	(*)	(*)	(*)	(*)			
C49,	(*)	(*)	(*)	(*)	(*)	(*)			
C58,	---	---	---	(*)	(*)	---			
C61,	---	---	---	---	---	(*)			
C62,	---	---	---	---	---	(*)			
C74	---	---	---	---	---	(*)			
C29,	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 3900 uuf ±10%; 500 vdcw; JAN type CM35B392K; JAN spec JAN–C–5. (4000 uuf in unlettered through E models.)	C29: Plate circuit bypass, V7. C33: Plate bypass, V8. C35: Grid return bypass, power amplifier V9. C38: Cathode bypass, power amplifier V9. C39: Screen bypass, poer amplifier V9. C45: B+ supply line r-f bypass. C52: Filament-cathode r-f bypass, power amplifier V9.	3K3539221
C33,	(*)	(*)	(*)	(*)	(*)	---			
C35,	(*)	(*)	(*)	(*)	(*)	(*)			
C38,	(*)	(*)	(*)	(*)	(*)	(*)			
C39,	(*)	(*)	(*)	(*)	(*)	(*)			
C45,	(*)	(*)	(*)	(*)	(*)	(*)			
C52	(*)	(*)	(*)	(*)	(*)	(*)			
C59,	---	---	---	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 4700 uuf ±10%; 500 vdcw; JAN type CM35B472K; JAN spec JAN–C–5. (500 uuf in D and E models.)	C59: Plate circuit bypass, crystal oscillator V1. C60: D-c blocking, plate circuit of crystal oscillator V1. C76: R-f bypass, VTVM cathode circuit V3.	3K3547221
C60,	---	---	---	(*)	(*)	(*)			
C76	---	---	---	---	---	(*)			
C6	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 5100 uuf ±5%; 500 vdcw; JAN type CM35B512J; JAN spec JAN-spec JAN–C–5. (5000 uuf in unlettered through E models.)	Frequency correction network V3 grid.	3K3551222
C34	---	---	---	---	---	(*)	CAPACITOR, fixed: mica dielectric; 8200 uuf ±10%; 500 vdcw; JAN type CM35B822K; JAN spec JAN–C–5.	Plate circuit bypass, V8	3K3582221
C34	(*)	(*)	(*)	(*)	(*)	---	CAPACITOR: fixed; mica; 10,000 uuf ±10%; 600 vdcw; JAN type CM45B103K.	Plate circuit bypass, V8	3K4510321
C53	---	---	---	(*)	(*)	(*)	CAPACITOR, fixed: mica dielectric; 10,000 uuf ±10%; 300 vdcw; JAN type CM35B103K; JAN spec JAN–C–5.	Bypass in grid bias supply; circuit for power amplifier V9.	3K3510321

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
C4, C67	(*) ---	(*) ---	(*) ---	(*) ---	(*) ---	(*) (*)	CAPACITOR, fixed: paper dielectric; 50,000 uuf ±10%; 600 v; JAN type CP53B1EF503K; JAN spec JAN–C–2.	C4: Audio coupling, V1 to V3. C67: Arc suppression, RL1 contacts.	3DA50–303
C72	---	---	---	---	---	(*)	CAPACITOR, fixed: paper dielectric; JAN type CP53B1EG254K; 250,000 uuf ±10%; 1000 v; JAN spec JAN–C–2.	Plate circuit bypass, a-f amplifier V1.	3DA250–446
C73	---	---	---	---	---	(*)	CAPACITOR, fixed: paper dielectric; 1 uf +40% −15%; 100 v; JAN type CP54B1EB105K; JAN spec JAN–C–25.	D-c blocking capacitor, T10 primary.	3DB1–173
C46, C47	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	--- ---	CAPACITOR, fixed: paper dielectric; 1 sect; 3 uf ±10% 600 vdcw; HS metal can; $2\frac{3}{8}''$ lg x 2″ diam excluding term; oil filled; 2 solder lug term on bottom; Dubilier #KZ3035H.	B+ filters, V10 and V11 output.	3DB3.26
C46, C47	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	CAPACITOR: fixed; paper; 1 sect; 3.7 uf +50% −20%; 600 vdcw.	B+ filters, V10 and V11 output.	3DB3E7
C44	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: paper dielectric; 4 uf +20% −10%; 600 v; JAN type CP40B2FF405V; JAN spec JAN–C–25.	B+ circuit bypass, plate supply line.	3DB4–303
C3	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: electrolytic dielectric; 25 uf; 50 vdcw; JAN type CE62F250G; JAN spec JAN–C–62.	Cathode bypass, audio amp V1.	3DB25–124
C50, C51	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	CAPACITOR: fixed; electrolytic; 25 uf; 50 vdcw; JAN type CE61F250G.	C50 and C51: Microphone current supply filters.	3DB25–125
C40	(*)	(*)	(*)	(*)	(*)	(*)	CAPACITOR, variable: air dielectric; dual sect, plate meshing type; 3 uuf min, 35 uuf max for ea sect; air gap .060″; $3\frac{11}{32}''$ lg x 1″ wd x $1\frac{1}{2}''$ h o/a excluding shaft $\frac{1}{4}''$ diam x $\frac{1}{2}''$ lg beyond bushing, $\frac{5}{16}''$ —32 bushing for mtg; 18 plates per sect finished per spec 72–53; 360 deg rotation; ceramic insulation; solder lug term; mts by two #6–32 tapped holes on $2\frac{5}{16}''$ mtg/c; Hammarlund #HFD; Hallicrafters part/dwg #48B223.	Plate tuning, V9.	3D9035V–20
C17, C32, C41	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	CAPACITOR, variable: air dielectric; plate meshing type, single sect; 4 uuf min, 54 uuf max ±7% of max; air gap .015″; $1\frac{3}{32}''$ lg excluding shaft x $\frac{15}{16}''$ wd x $1\frac{7}{32}''$ h; hex shaft $\frac{1}{4}''$ across flats $\frac{5}{16}''$ lg beyond mtg surface; screw driver adj; 15 soldered brass silver pl plates in accordance w/U. S. Army spec 72–53; 180 deg counterclockwise rotation; ceramic insulation; 2 solder lug term; two #4–40 tapped holes on $\frac{21}{32}''$ mtg/c; Sickles FW part #ARL–13; Hallicrafters part/dwg #48A222. (Minimum capacity 3 uuf in unlettered through H models.)	C17: Plate tuning, V5. C32: Plate tuning, V8. C41: ANTENNA LOADING.	3D9054V
C11, C12, C68, C69, C70, C71	(*) (*) --- --- --- ---	(*) (*) --- --- --- ---	(*) (*) --- --- --- ---	(*) (*) --- --- --- ---	(*) (*) --- --- --- ---	(*) (*) (*) (*) (*) (*)	CAPACITOR ASSEMBLY: air dielectric; 2 sect on separate shafts, plate meshing type; 4 uuf min, 54 uuf max ±7% of max; SLC; air gap .015″; $1\frac{15}{16}''$ lg x $1\frac{3}{8}''$ wd x $1\frac{5}{32}''$ d excluding shaft and term, shaft $\frac{5}{16}''$ lg x $\frac{9}{32}''$ diam; screw driver adj; 15 brass silver pl plates; 360 deg rotation; ceramic insulation; 2 solder lug term per sect; mts by two #4–40 tapped holes on $1\frac{21}{32}''$ mtg/c; Sickles FW #ARL. (Minimum capacity 3 uuf in unlettered through H models.)	C11: Plate tuning, tripler V4. C12: Grid tuning, V5. C68: Plate tuning, V6. C69: Grid tuning, V7. C70: Plate tuning, V7. C71: Grid tuning, V8.	3DE54V

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	(*)	CASE: Army-Navy Case CY–17( )/TRC–1; plywood, olive drab finish; 22½″ lg x 17¾″ h x 16″ deep o/a; interior fitted w/2 slide type vibration mounts, perforated metal tray and protective canvas canopy; 1 folding handle located on ea end of case; lid has metal support arm, lid held closed by 6 metal strike fasteners; Churchill Cabinet Co. as per Hallicrafters part/dwg #78B582; Sig C dwg #SC–D–32194.	Holds transmitter	2Z1891–17
	(*)	(*)	(*)	(*)	(*)	(*)	CLAMP: steel; hot tinned dipped; uses one #8–32 x 1⅜″ lg screw, hex nut and lockwasher not supplied; 1″ h x 2¾″ diam o/a approx, three 9/32″ x 5/32″ mtg holes spaced 120° apart; to fit 2″ diam Dubilier #TQ capacitor; Hallicrafters part/dwg #76A506.	Holds filter capacitors	2Z2646.63
	(*)	(*)	(*)	(*)	(*)	(*)	CLAMP: steel; cadmium pl and Cronak dip; 5.078″ h x 5⅞″ wd x 1¼″ thk o/a; four 3/16″ diam mtg holes on 5.375″ x .750″ mtg/c; Hallicrafters part/dwg #76B540.	Holds power transformer	2Z2646.64
	(*)	(*)	(*)	(*)	(*)	(*)	CLAMP: stainless steel; 1⅜″ diam x ¾″ h approx o/a; mtg by #10 screw, not supplied, through hole in bracket; to hold medium shell octal base; clamping action provided by attached clip; Birtcher #926C.	Holds tubes V–10 and V–11	2Z2636–26
	(*)	(*)	(*)	(*)	(*)	(*)	CLEANER ELEMENT, air: screen type; steel container; 8 11/16″ lg x 4⅝″ wd x 15/32″ thk o/a; Hallicrafters part/dwg #80C103; Sig C dwg #SC–C16721. (Replaces replaceable type cleaners issued with unlettered through E models.)	Air filters	6Z3856–67.1
	(*)	(*)	(*)	(*)	(*)	(*)	CLIP: Tube cont; uninsulated	For V9 plate connection	2Z2712.27
L1,	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: choke; single wnd, universal pie wnd; unshielded; 770 uh at 790 kc, 10 ma max cur 97.41 ohms ±20% DC resistance; 190½ turns of 7–41 Litz SE; 1½″ lg x 1″ diam approx o/a; phenolic form grade LTS–E–2 per JAN–P–13; air core; form ½″ OD x 1½″ lg; mtg by means of single #6–32 tapped hole, in coil form plug; 2 radial solder lug term; form stamped ″53B182″; treated to resist fungus; Hallicrafters part/dwg 53B182.	L1: Part of crystal oscillator feedback circuit. L6: Plate load, crystal oscillator V1.	3C320–8
L6	---	---	---	(*)	(*)	(*)			
L2	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: choke; single wnd, 2 pie universal wnd; unshielded; 5 mh at 250 kc, 10 ma max cur, 36 ohms DC resistance; 5–40 Litz SE wire; 1½″ lg x 1⅛″ diam approx o/a; phenolic form grade LTS–E–2 per JAN–P–13; air core; form ½″ OD x 1½″ lg; mtg by means of one #6–32 tapped hole in coil form plug; 2 solder lug term; form stamped ″53B 183″; Hallicrafters part/dwg 53B183.	R-f choke, plate, V3	2C6900–14/C4
L3	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: plate tank; single wnd, space wnd; unshielded; 4 turns of #8 bare copper wire; 2 13/16″ lg x 1¾″ h x 1″ wd o/a; air wnd; mtg by means of one 11/64″ diam hole in ea solder lug on 2 5/16″ mtg/c; 2 solder lug term and 1 wire lead term from CT; Hallicrafters part/-dwg 51B1166.	Part of power amplifier V9, plate tank.	2C6900–14/C6

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
L4	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: single wnd, space wnd; unshielded; 1 turn #12 wire; 1″ diam x ¼″ wd approx excluding leads; air wnd; mtg by means of 2 wire leads; Hallicrafters part/dwg 51B1167.	Antenna coupling loop	2C6900-14/C5
L5	(*)	(*)	(*)	(*)	(*)	(*)	COIL, RF: choke; single wnd, single layer wnd; unshielded; 40 turns #28 E copper wire; approx 1⅞″ lg x ⅜″ diam less leads; solid lucite coil form; one #6-32 tapped axial mtg hole at ea end, 1 hole 3/16″ d, other ⅜″ d; 2 radial wire lead term; Hallicrafters part/dwg 53B184.	R-f choke, power amplifier plate V9.	3C1082-2A
L7	---	---	---	---	---	(*)	COIL, RF: single wnd, single layer wnd; unshielded; 2.2 uh ±10%; 520 ma, 1.1 ohm ±20% DC resistance; body 1¼″ lg x ¼″ OD; copper WW on ins core and entire assem molded in phenolic compound; mts by two 1½″ lg axial wire leads; two axial wire terms; marked 2 red bands on mottled gray housing; insulated body; IRC type #CL-1.	Part of plate load, V8.	3C375-52
T2	---	---	---	(*)	(*)	---	COIL, RF: single wnd space wnd, rectangular aluminum shield; 4″ h x 1⅞″ x 17/16″ d; lucite form; air core; built in trimmer; 2 fixed capacitors, 2 resistors; screw driver adj at top; can marked ″T2-2ND DOUB.″	V5 plate tuning	3C323-34Z6
T3	---	---	---	(*)	(*)	---	COIL, RF: single wnd space wnd; rectangular aluminum can 4″ h x 2″ wd x 17/16″ d; lucite form; air core; built-in trimmer, 3 fixed capacitors, 2 resistors; screw driver adj at top; can marked "T3-3RD DOUB."	Plate tuning, V6	3C323-3425
T3	(*)	(*)	(*)	---	---	---	COIL, RF: air core shielded 17.5-25 mc; ½″ diam lucite form; metal can; single tuned by variable air capacitor; 2 fixed capacitors, 2 resistors.	V6 plate tuning	2C6900-14/C2
T4	---	---	---	(*)	(*)	---	COIL, RF: single wnd rectangular aluminum can; 3″ h x 2″ wd x 17/16″ d; lucite form; air core; built-in trimmer; 3 fixed capacitors, 2 resistors; can marked "T4-4TH DOUB."	Couples V7 plate to V8 grid.	3C323-34Z3
T4	(*)	(*)	(*)	---	---	---	COIL, RF: 35-50 mc metal shield can; 5 turns #20 enamel wire; lucite form; tuned by variable air capacitor; 3 fixed capacitors, 2 resistors.	Couples V7 plate to V8 grid.	2C6900-14/C1
P/o P11	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, female contact: single round cont; straight banana jack type; nickel pl brass head 13/32″ lg x ⅜″ OD, .166″ ID; ⅝″ lg x 3″ diam o/a; cylindrical hex head nickel pl brass body w/#¼ 28 thread, .166″ ID; wire attached by means of solder lug; mts by hex nut on #¼ 28 thread; furnished w/hex nut and solder lug; Johnson EF #74.	Part of fan motor power connector P11.	2Z3063-33
P14	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, male contact: 2 flat parallel blades; straight; 1¼″ lg x 1½″ diam including clamp but less cont; 10 amp 250 v, 15 amp 125 v; cylindrical rubber body; cable opening .296″ to .562″ diam; connector attached to AC cable; includes adj cord grip; Hubbell type #9754.	A-c line connector	6Z1735

Ref symbol	A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
P7, P8	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, female contact: Sig C Socket SO–239; single round; straight; 1 1/16″ lg x 1″ sq; cylindrical zinc shell, silver pl; mica filled bakelite insert; four .120″ diam mtg holes on 23/32″ sq mtg/c; Amphenol #83–1R.	P7: Plug for ANTENNA connection. P8: Plug for connecting RECEIVER antenna to transmitter.	2Z8799–239
P9	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, female contact: seven #20 round pol; straight type; 1 9/32″ sq x 29/32″ lg, less cont; cylindrical aluminum body; molded black bakelite insert; cable opening 7/8″ diam; four .120″ diam mtg holes on 31/32″ sq mtg/c; threaded 1″ –20 for cable mtg; Amphenol #3102–16S–1S.	CONTROL CABLE connector.	2Z8677.49
P10	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR: 2 banana plug cont; straight; 1 13/16″ x 1/2″ wd x 1/4″ thk, less cont; c/o BLOCK, contact, Hallicrafters part/dwg #8A996 and CONNECTOR, male contact, Hallicrafters part/dwg #36A047; wires attached by means of solder lugs; mts by two .147″ diam holes on 1 7/16″ mtg/c; furnished w/hex nuts and solder lugs; Hallicrafters part/dwg #41–14324.	Fan connector to power input.	2Z3022–37
P11	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR, receptacle: 2 round female cont; straight banana jack type; jack head 13/32 in. lg x 3/8 in. OD, .166 in. ID; 1 1/4 in. lg x 1 1/8 in. wd x 5/8 in. thk, less cont; c/o BLOCK, cont, Hallicrafters part/dwg #8A 993 and CONNECTOR, female cont, Hallicrafters part/dwg #36A046; wires attached by means of solder lugs; mts by two #10–32 tapped holes 7/16 in. deep on 3/4 in. mtg/c; furnished w/hex nut and solder lug; Hallicrafters part/dwg #411 4325; black plastic type LTS–E–2, per spec JAN–P–13; lacquer per spec JAN–CO173.	Fan connector for power input.	2Z3063–163
	(*)	(*)	(*)	(*)	(*)	(*)	COVER: steel, cadmium pl; rectangular cover; 2 13/64″ lg x 1 43/64″ wd w/1/4″ sides; marked "XTAL"; 11/64″ diam hole in ctr for mtg knob; Hallicrafters part/dwg #66B580.	Fits over crystal oven and is held in place by dimples in 2 sides.	2Z3351–219
	(*)	(*)	(*)	(*)	(*)	(*)	COVER:	Protects telephone jack.	2Z3352.37
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: type AJ5–35; shaft 5/16″ diam undercut 0.125″ below head, 0.35″ from head to cam.		6Z3809–9.1
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: wing type; head 1 1/8″ lg x 7/16″ h x 0.062″ thk; shaft 5/16″ diam undercut 0.125″ below head, 0.35″ from head to cam.		6Z3809–3.1
	(*)	(*)	(*)	(*)	(*)	(*)	FASTENER, Dzus: wing type; stud 3/8″ diam, wing 1 1/4″ wd x 7/16″ h x 1 1/16″ lg o/a.		6Z3809–14
T9	(*)	(*)	(*)	(*)	(*)	(*)	FILTER, low pass: attenuation 30 db or more at 3000 cyc and higher; 3 11/16″ lg x 2 11/16″ wd x 2 7/32″ h o/a; input and output impedances 500 ohms; rectangular metal case; six .190″ diam mtg holes on fl on 2 3/8″x .750″ mtg/c; 3 solder lug term on bottom; case stamped w/ckt diagram, electrical data, and Hallicrafters part No; Chi Trans spec #15735; Hallicrafters part/dwg #56C124; constructed in accordance with spec MIL–T–27.	Band pass audio filter for intercommunication channel.	3Z1893–22

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
T11	---	---	---	---	---	(*)	FILTER, low-pass: 3″ lg x 1.87″ wd x 1.44″ d o/a; input and output impedance 10,000 ohms; rectangular aluminum shield can; mts to chassis by means of two #6–32 spade bolts on 1⅜″ mtg/c; 5 solder lug term on term board marked "1, 2, 3, 4, and 6"; treated to resist fungus, top of can marked T–11; assembly incl C–8, C–63, C–64, C–65, R–56 and R–58; Hallicrafters part/dwg #50 C437; fungus proof per spec JAN–T–152; fungicidal material per spec JAN–C–173; Class 1.	Harmonic filter network, plate of V2.	2Z4376–107
F2	(*)	(*)	(*)	(*)	(*)	(*)	FUSE, cartridge: 5 amp, percentage of rating and blow time; 110%-life, 135%–O–1 hr, 200%–O–2 min; 250 v; 1 time; glass body; ferrule term; 1¼″ lg x ¼″ diam; mts inside fuseholder; Littlefuse #312005.	A-c line fuse	3Z2605.2
F3	(*)	(*)	(*)	(*)	(*)	(*)	FUSE, cartridge: .375 amp, percentage of rating and blow time: 110%-life, 135%–O–1 hr, 200–O–2 min; 250 v; 1 time; glass body; ferrule term; 1¼″ lg x ¼″ diam; mts inside fuseholder; Littlefuse #312.375. (.25 amp in original unlettered through E models.)	H-v return fuse	3Z2588.1
F1,	(*)	(*)	(*)	(*)	(*)	---	FUSE, cartridge: ¼ amp; percentage of rating and blow time: 110%–life, 135%–O–1 hr, 200%–O–2 min; 250 v; 1 time; glass body; ferrule term; 1¼″ lg x ¼″ diam; mts inside fuseholder; Littlefuse #312.250.	F1:PA fuse	3Z2587
F4	---	---	---	---	---	(*)		F4: Selenium rectifier fuse.	
	(*)	(*)	(*)	(*)	(*)	(*)	GASKET: black rubber 40–50 durometer; 4 holes; round 2$\frac{11}{16}$″ OD x 2$\frac{3}{16}$″ ID x $\frac{5}{64}$″ thk; three ⅛″ diam mtg holes spaced 120° apart on 1$\frac{7}{32}$″ rad; gasket for Marion Elec instr #H2 meter; Hallicrafters part/dwg #12B055.	Gasket between meter and front panel.	2Z4867.396
	(*)	(*)	(*)	(*)	(*)	(*)	GEAR: spur; 36 teeth; 1$\frac{3}{16}$″ diam x 0.334″ thk o/a; ¼″ bore.	Anti-backlash for plate amplifier tuning capacitor.	2Z4875–151
	(*)	(*)	(*)	(*)	(*)	(*)	GROMMET: plastic; fits ⅝″ hole.	For A-C LINE cord	6Z4920–27
FS1 thru FS4	(*)	(*)	(*)	(*)	(*)	(*)	HOLDER, fuse: extractor post type; for single 3AG cartridge fuse; black bakelite; 15 amp, 250 v; 2$\frac{13}{32}$″ lg x $\frac{11}{16}$″ diam o/a; thru panel mtg by means of threaded bushing; 2 solder lug term; Buss #NKP–L.	Holder for fuses F1 through F4.	3Z3285–2
	(*)	(*)	(*)	(*)	(*)	---	INSULATOR, standoff: cylindrical; JAN type NS4W0116.	Component support	3G3501–16.1
	(*)	(*)	(*)	(*)	(*)	(*)	INSULATOR, standoff: cylindrical; JAN type NS4W0205.	Component support	3G3502–05.2
	---	---	---	---	---	(*)	INSULATOR, standoff: cylindrical; JAN type NS4W0106.	Component support	3G3501–06.1
	(*)	(*)	(*)	(*)	(*)	(*)	INSULATOR, bushing: conical shape; JAN type NS4W4101.	D-c voltage feedthrough	3G3541–01.1
	(*)	(*)	(*)	(*)	(*)	(*)	INSULATOR, bowl: conical shape; JAN type NS4W420.	D-c voltage feedthrough.	3G3542–01.1
	---	---	---	---	---	(*)	INSULATOR: standoff; steatite; JAN type NS4W1016.	Component support	3G3510–16
J1	(*)	(*)	(*)	(*)	(*)	(*)	JACK, telephone: JAN type JJ–033; for Sig C Plugs PL–46 and PL–68.	Receives microphone plug.	2Z5533

968874—52—23

Ref symbol	A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
J2	(*)	(*)	(*)	(*)	(*)	(*)	JACK, telephone: JAN type JJ-034; for 2 cond plug .25 in. diam.	Receives HEADSET plug.	2Z5534
	(*)	(*)	(*)	(*)	(*)	(*)	KNOB: pointer; black bakelite; 1¼″ lg x ⅝″ wd x ⅝″ h o/a; brass insert; shaft hole ½″ Kurz-Kasch #S-292-3L.	CABLE COMPENSATOR adjustment, METER SWITCH, and CARRIER CONTROL knobs.	2Z5848
	(*)	(*)	(*)	(*)	(*)	(*)	KNOB: round; black bakelite; 1″ diam x 21/32″ thk o/a; brass insert; hole ⅜″ d; straight knurl; Kurz-Kasch #S-52-64 w/hole size modified; Hallicrafters part/dwg #15A211.	Power amplifier plate tuning knob.	2Z5822-143
	(*)	(*)	(*)	(*)	(*)	(*)	KNOB: round; black E wood, maple or oak; pilot hole .171 in. diam on flat face for #8 wood screw ¾″ diam x ⅝″ thk; pilot hole 3/16″ d; Amer Cabt Hdwe #617.	Knob for use on crystal oven cover.	2Z5843.11
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; for ¼″ hex shaft.	For tuning T1 primary	2Z5822-141
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16″ diam shaft.	For tuning T2	2Z5788-67
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16″ diam shaft.	For tuning T4.	2Z5788-69
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16″ diam shaft.	For tuning T5.	2Z5786.64
	---	---	---	(*)	(*)	---	KNOB: round; black bakelite for ¼″ diam hex shaft.	For tuning primary of T11.	2Z5822-148
	---	---	---	(*)	(*)	---	KNOB: round; black bakelite for ¼″ diam hex shaft.	For tuning secondary of T11.	2Z5822-149
	(*)	(*)	(*)	(*)	(*)	---	KNOB: round; black bakelite; 3/16″ diam shaft.	For tuning T3.	2Z5788-68
PL1, PL2	(*)	(*)	(*)	(*)	(*)	(*)	LAMP, incandescent: Sig C Lamp LM-52; 6-8 v .15 amp; bulb T-3¼ clear; 1 13/16″ lg o/a; miniature bayonet base; tungsten fil; GE Mazda #47; Hallicrafters part/dwg #39 A028.	PL1: PLATE ON-off indicator lamp. PL2: FILAMENT ON-off indicator lamp.	2Z5952
	(*)	(*)	(*)	(*)	(*)	(*)	LENS: indicator, light; green	FILAMENT ON indicator lens.	2Z5891-52
	(*)	(*)	(*)	(*)	(*)	(*)	LENS: indicator, light; red	PLATE ON indicator lens	2Z5891-53
	(*)	(*)	(*)	(*)	(*)	(*)	LIGHT, indicator: w/o lens; for miniature bayonet base T-3¼ bulb; open frame; nickel pl steel shell; 2 7/32″ lg x ⅞″ wd x 1 1/16″ h o/a; jewel threaded 11/16″ -27; 2 solder lug term; pol disks; Johnson EF #147-421.	For panel indicator bulbs.	2Z5883-105
M1	(*)	(*)	(*)	---	---	---	METER, ammeter: DC; range 0-3 ma; round bakelite phenolic case; 2⅝″ diam barrel; 1 1/16″ d behind fl excluding term; round fl 2 11/16″ diam; three ⅛″ diam mtg holes on rad of 1.22 ″space 120 deg apart on fl.	Tuning and modulation level indicator.	3F893-3
M1	---	---	---	(*)	(*)	(*)	METER, ammeter: DC; range 0-3 ma; round black phenolic case; 2 5/32″ diam barrel; 1 1/15″ d behind fl excluding term; round fl 2 11/16″ diam; three .125″ diam mtg holes on rad of 1.220″ spaced 120 deg apart on fl; 2 solder lug term; Marion Elec Instr type #BM-2; Hallicrafters part/dwg #82C167.	Tuning and modulation level indicator.	3F893-5
P/o FM1	(*)	(*)	(*)	(*)	(*)	(*)	MOTOR, AC: shaded pole type; .005 hp, 2700 rpm; open frame; 55°C max oper temp; plain shaft; 2 1/16″ lg x 3¼″ wd x 3 5/16″ h excluding shaft, .1875″ diam shaft extending from frame; 115 v AC, 60 cyc, single ph, .29 amp; mts to bracket by means of four #¼ 28 tapped holes on 2.311″ x .875″ mtg/c; cad pl	Fan motor	3H3000-42

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
							steel rotor, rear ball thrust bearing; coil assembly treated for fungus resistance; Bar Col #AYAR 5563.		
	(*)	(*)	(*)	(*)	(*)	(*)	MOUNT: vibration; 2 3/8″ sq x 1 1/16″ h o/a		2Z8404–2
P1 through P5, P12, P13	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	POST, binding: screw type; 5/8″ diam x 1 1/64″ lg open above mtg surface; #8–32 mtg screw 13/16″ lg; rubber cap, brass nickel pl base; adj wire slot 1/8″ x 5/32″ when open; knurled base, w/o dowel; soft rubber cap; Eby #7669; Hallicrafters part/dwg #11A276.	P1 and P2: Receiver audio terminals. P3: Ground post (SH.) P4 and P5: Transformer audio line input (TR-SG.). P12 and P13: Telephone input (EE–8 TEL.).	3Z286
CH1	(*)	(*)	(*)	(*)	(*)	(*)	REACTOR: 1 sect; 10 hy, .300 amp; 164 ohms ±8% DC resistance; voltage breakdown 2500 v RMS; HS metal case; 5 19/64″ lg x 4 7/64″ wd x 4 9/16″ h less term; six .230″ diam mtg holes on fl on 4.750″ x 1.250″ mtg/c; 2 solder lug term on bottom; Chi Trans spec #15678; Hallicrafters part/dwg #56C125. (11.6 h. in H model.)	B+ filter choke	3C317–47
CH2	---	---	---	(*)	(*)	(*)	REACTOR: 1 sect; 5 hy, .050 amp; 212 ohms DC resistance; 1000 RMS; HS metal case; 2 31/32″ lg x 2 7/16″ wd x 1 57/64″ h o/a; four .156″ diam mtg holes on fl on 2.125″ x .500″ mtg/c; 2 solder lug term on bottom; Chi Trans #88 43–D; (4.7 hy in H model; not in unlettered through C models unless modified by MWO.)	Filter choke for microphone voltage supply.	3C323–56C
RE1	(*)	(*)	(*)	(*)	(*)	(*)	RECTIFIER, metallic: selenium; input 51 v AC, 60 cyc; output 36 v DC ±5%, .220 amp; rectangular, 3 7/8″ lg x 1″ sq, excluding term; mtd by means of #8–32 thd steel stud; mtg; fungus resistance; Vickers Elec Div #22–188–2. (Unlettered through E models used a 33 v AC input, 24 v DC output rectifier.)	Relay and microphone voltage supply rectifier.	3H4860–145
RL1	(*)	(*)	(*)	(*)	(*)	(*	RELAY, armature; DPDT plus SPST normally open; cont rating 10 amp, 115 v continuous; pure silver cont 1/4″ diam; wnd; 24 v DC 280 ohms DC resistance; pol; ins coil; solder lug term on coil and cont; 2 3/4″ lg x 1 1/2″ wd x 1 5/16″ h approx o/a; two #6–32 tapped mtg holes on 1 7/16″ ctr; Adv Elec #2000–1B; fungus treated; Hallicrafters part/dwg #21A102.	Antenna transfer and plate voltage control.	2Z7592–54
R35	---	---	---	(*)	(*)	---	RESISTOR, fixed: WW; .336 ohms ±1%; 1/3 w; JAN type RB11BOR336F.	Meter shunt, cathode V9.	3RB1–3360
R35	(*)	(*)	(*)	---	---	(*)	RESISTOR, fixed: WW; .5 ohms ±1%; 1/3 w; JAN type RB11BOR500F.	Meter shunt, cathode V9.	3RB1–5000.3
R34	---	---	---	(*)	(*)	---	RESISTOR, fixed: WW; 8.333 ohm ±1%; 1/2 w; JAN type RB12B8R333F.	Meter shunt, grid V9.	3RB2–8333
R34	(*)	(*)	(*)	---	---	(*)	RESISTOR, fixed: WW; 12.50 ohms ±1%; 1/2 w; JAN type RB12B12R50F.	Meter shunt, grid V9	3RB3–1250.2
R40, R41, R47	(*) (*) ---	(*) (*) (*)	(*) (*) ---	(*) --- (*)	(*) --- (*)	-- -- (*	RESISTOR, fixed: comp; 510 ±5%; 1/2 w; JAN type RC20BF511J. (R40 is 500 in unlettered through E models, R41 is 500 in unlettered through C models, and R47 is 500 in B, D, and E models.)	R40 and R41: Micro phone supply filter. R47: Low-voltage supply bleeder.	3RC20BF511J

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R39	(*)	(*)	(*)	(*)	(*)	---	RESISTOR: fixed; comp; 180 ohm ±10%; ½ w; JAN type RC20BF181K. (200 ohms in unlettered through E models.)	Voltage divider, output to T9.	3RC20BF181K
R18, R21, R25, R28	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	(*) (*) (*) (*)	RESISTOR, fixed: comp; 1000 ohms ±10%; ½ w; JAN type RC20BF102K.	R18: Grid return and meter shunt, V5. R21: Grid return and meter shunt, V6. R25: Grid return and meter shunt, V7. R28: Grid return and meter shunt, V8.	3RC20BF102K
R2	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 2000 ohms ±5%; ½ w; JAN type RC20BF202J.	Cathode bias, audio amplifier V1.	3RC20BF202J
R57	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 3000 ohms ±5%; ½ w; JAN type RC20BF302J.	Frequency compensation, grid of phase modulator V3.	3RC20BF302J
R39	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 3900 ohms ±10%; ½ w; JAN type RC20BF392K.	Voltage divider, output of T12.	3RC20BF392K
R30, R31	--- ---	--- ---	--- ---	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: comp; 5100 ohms ±5%; ½ w; JAN type RC20BF512J. (5000 ohms in D and E models.)	Grid-leak bias, power amplifier V9.	3RC20BF512J
R30, R31, R53	(*) (*) ---	(*) (*) ---	(*) (*) ---	--- --- ---	--- --- ---	--- --- (*)	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	R30 and R31: Grid-leak bias, power amplifier V9. R53: Part of plate load, V3.	3RC20BF103K
R38	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 5600 ohms ±10%; ½ w; JAN type RC20BF562K.	Voltage divider, output of T12.	3RC20BF562K
R38	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 330 ohms ±10%; ½ w; JAN type RC20BF331K. (300 ohms in unlettered through E models.)	Voltage divider, output of T9.	3RC20BF331K
R54	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 6800 ohms ±10%; ½ w; JAN type RC20BF682K.	Part of plate load, V3	3RC20BF682K
R51	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: comp; 15,000 ohms ±10%; ½ w; JAN type RC20BF153K.	Shunts L1 in crystal oscillator circuit to increase operational range.	3RC20BF153K
R56, R58	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	Part of low-pass filter T11.	3RC20BF273K
R14	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 30,000 ohms ±5%; ½ w; JAN type RC20BF303J.	Cathode bias, V3	3RC20BF303J
R24	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	Grid return, V7	3RC20BF154K
R24, R27	--- (*)	--- (*)	--- (*)	--- (*)	--- (*)	(*) (*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K. (R27 is 50,000 ohms in the unlettered through E models.)	R24: Grid return, V7 R27: Grid return, V8.	3RC20BF473K
R11	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K. (50,000 in original unlettered through E models.)	Audio phasing network in grid circuit of V3.	3RC20BF473K
R11	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 51,000 ohms ±5%; ½ w; JAN type RC20BF513J.	Audio phasing network in grid circuit of V3.	3RC20BF513J
R10	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	Grid bias, oscilator amplifier V2.	3RC20BF104K
R9	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 200,000 ohms ±5%; ½ w; JAN type RC20BF204J.	Frequency correction isolation and grid leak, grid network, V3.	3 RC20BF204J

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R15, R50	(*) ---	(*) ---	(*) ---	(*) (*)	(*) (*)	(*) ---	RESISTOR, fixed: comp; 240,000 ohms ±5%; ½ w; JAN type RC20BF244J. (R15 is 250,000 ohms in the unlettered through E models.) (R50 is 250,000 ohms in the D and E model.)	R15: Grid bias, tripler V4 (grid resistor for V3 on D and E models). R50: Grid bias tripler V4.	
R8	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 240,000 ohms ±5%; ½ w; JAN type RC20BF244J. (250,000 ohms in the unlettered through E models.)	Frequency connection, isolation and grid leak, grid network V3.	3RC20BF244J
R17	---	---	---	(*)	(*)	---	RESISTOR, fixed: comp; 50,000 ohms ±10%; ½ w; JAN type RC20BF503K.	Grid bias, V5	3RC20BF503K
R17, R20	(*) (*)	(*) (*)	(*) (*)	--- (*)	--- (*)	(*) (*)	RESISTOR, fixed: comp; 270,000 ohms ±10%; ½ w; JAN type RC20BF274K. (R20 is 250 K in unlettered through E models.)	R17: Grid bias, V5. R20: Grid bias, V6.	3RC20BF274K
R1	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 360,000 ohms ±5%; ½ w; JAN type RC20BF364J. (350,000 ohms in the unlettered through E models.)	Grid bias, crystal oscillator V1.	3RC20BF364J
R60, R69	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	RESISTOR, fixed: comp; 390,000 ohms ±10%; ½ w; JAN type RC20BF394K.	R60: D-c grid return, VTVM section, V3. R69: VTVM grid coupling, V3.	3RC20BF394K
R67	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K.	Isolation of grid loading (V3, VTVM section).	3RC20BF105K
R42, R70	(*) ---	(*) ---	(*) ---	(*) ---	(*) ---	(*) (*)	RESISTOR, fixed: comp; 15 ohms ±10%; 1 w; JAN type RC30BF150K.	R42: Filament dropping, indicator lamp PL–2. R70: Parasitic suppressor, V5 grid.	3RC30BF150K
R40 R68	--- ---	--- ---	--- ---	--- ---	--- ---	(*) (*)	RESISTOR, fixed: comp; 100 ohms ±10%; 1 w; JAN type RC30BF101K.	R40: Microphone voltage supply filter. R68: Microphone current limiting.	3RC30BF101K
R64	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 470 ohms ±10%; 1 w; JAN type RC30BF471K.	Voltage divider network, VTVM section, V3.	3RC30BF471K
R55	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 1000 ohms ±10%; 1 w; JAN type RC30BF102K.	Plate circuit isolation, V7.	3RC30BF102K
R63	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 1500 ohms ±10%; 1 w; JAN type RC30BF152K.	Plate load, VTVM section, V3.	3RC30BF152K
R45	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: comp; 1800 ohms ±10%; 1 w; JAN type RC30BF182K. (2000 ohms in D and E models.)	Plate isolation, V6	3RC30BF182K
R22, R52	(*) ---	(*) ---	(*) ---	(*) ---	(*) ---	(*) (*)	RESISTOR, fixed: comp; 2,000 ohms ±5%; 1 w; JAN type RC30BF202J.	R22: Plate isolation, V5. R52: Plate isolation, V4.	3RC30BF202J
R59	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 18,000 ohms ±10%; 1 w; JAN type RC30BF183K.	R-f isolation, plate of a-f amplifier V1.	3RC30BF183K
R12	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 22,000 ohms ±10%; 1 w; JAN type RC30BF223K.	Plate load, oscillator amplifier V2.	3RC30BF223K
R12	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; JAN type RC30BF103K.	Plate load, oscillator amplifier V2.	3RC30BF103K
R7	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 56,000 ohms ±10%; 1 w; JAN type RC30BF563K.	Plate load, audio amplifier V1.	3RC30BF563K
R6, R7	(*) (*)	(*) (*)	(*) (*)	--- (*)	--- (*)	--- ---	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1 w; JAN type RC30BF473K. (R is 50,000 ohms in A, B and C models and R7 is 50,000 ohms in unlettered through E models.)	R6: Plate voltage dropping, crystal oscillator V1. R7: Plate load, audio amplifier V1.	3RC30BF473K
R29	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 68,000 ohms ±10%; 1 w; JAN type RC30BF683K.	Screen dropping, V8	3RC30BF683K
R29	(*)	(*)	(*)	(*)	(*)	---	RESISTOR, fixed: comp; 25k; ±5%; 1 w; JAN type RC30BF243J.	Screen dropping, V8	3RC30BF243J

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
R26	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 75,000 ohms ±5%; 1 w; JAN type RC30BF753J.	Screen dropping, V7	3RC30BF753J
R16,	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K.	R16: Screen dropping, V4.	3RC30BF104K
R71	---	---	---	---	---	(*)		R71: Screen bleeder, V2.	
R6	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: comp; 150,000 ohms ±10%; 1 w; JAN type RC30BF154K.	Plate voltage-dropping, crystal oscillator V1.	3RC30BF154K
R36	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 200,000 ohms ±5%; 1 w; JAN type RC30BF204J.	Screen dropping (for low power) V9.	3RC30BF204J
R13,	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 240,000 ohms ±5%; 1 w; JAN type RC30BF244J. (250,000 in unlettered through E models.)	R13: Screen dropping, V2.	3RC30BF244J
R23	(*)	(*)	(*)	(*)	(*)	(*)		R23: Screen dropping, V6.	
R19	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 510,000 ±5%; 1 w; JAN type RC30BF514J. (500,000 ohms in unlettered through E models.)	Screen dropping, V5	3RC30BF514J
R46,	---	(*)	---	---	---	---	RESISTOR, fixed: comp; 560 ohms ±10%; 1 w; JAN type RC30BF561K.	T6 primary loading	3RC30BF561K
R48	---	(*)	---	---	---	---			
R66	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 560 ohms ±10%; 1 w; JAN type RC30BF561K. (Early H models only.)	V8 plate circuit decoupling.	3RC30BF561K
R62	---	---	---	---	---	(*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; 2 w; JAN type RC42BF473K.	Voltage divider network VTVM section, V3.	3RC40BF473K
R49	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: WW; 80 ohms; 10 w; JAN type RW31F800. (75 ohms in D, E, and early H models.)	Power amplifier V9 fixed grid bias.	3RW17714
R43	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: WW; 100 ohms; 10 w; JAN type RW31F101J.	Filament voltage-dropping, indicator lamp PL-1.	3RW18326
R37	---	---	---	(*)	(*)	(*)	RESISTOR, fixed: WW; 3100 ohms; 12 w; JAN type RW32F312. (3500 ohms in D and E model.)	Screen voltage dropping V9.	3RW27323
R37	(*)	(*)	(*)	---	---	---	RESISTOR, fixed: WW; 15,000 ohms ±5%; 10 w.	Screen voltage dropping V9.	3Z6615-23
R32,	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: WW; 4000 ohms; 30 w; JAN type RW34F402.	R32: Plate and screen isolation V8.	3RW27945
R33	(*)	(*)	(*)	(*)	(*)	(*)		R33: Plate and screen isolation for oscillator section of V1 and for V2 through V7, and V9 (screens only).	
R65	---	---	---	---	---	(*)	RESISTOR, variable: comp; 2000 ohms ±10%; 2 w, 3 solder lug terms; enclosed metal case, 1 11/64″ diam x .620″ thk; rotating brush type; slotted shaft; linear taper; cont arm ins from case; normal torque; shaft-locking device; 3/8″ -32 threaded bushing 1/2″ lg; CTS #252. (2,500 in early H model.)	Bias adjustment, VTVM section, V2.	3Z7325-37
R44	(*)	(*)	(*)	(*)	(*)	(*)	RESISTOR, variable: comp; 100,000 ohms ±20% 1/2 w at 500 v; JAN type RV4APFK 104F.	Range adjustment for cable compensator.	3RV51018
YS1	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, crystal: mica-filled phenolic; .805″ lg x 47/64″ h x 5/16″ wd o/a; single .120″ diam hole, countersunk 7/32″ diam x 9/64″ d; cont for 3/32″ diam pins, .486″ c to c; silver pl beryllium copper cont; Cinch type #9816; Hallicrafters part/dwg #6A346.	Socket for crystal Y-1	2Z867.28
VS1 thru VS8,	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, tube: octal; 1 piece saddle mtg; two .156″ diam mtg holes on 1 1/2″ mtg/c; round mica-filled phenolic body 1 7/64″ diam	VS1: Socket for tube V101. VS2: Socket for tube V2. VS3: Socket for tube V3.	2Z8678.326

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
VS10, VS11	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	x 1/2" h, excluding term; phosphor-bronze silver pl cont; 4 ground lugs integral w/saddle; Cinch type #9886; Hallicrafters part/dwg #6A317.	VS4: Socket for tube V4. VS5: Socket for tube V5. VS6: Socket for tube V6. VS7: Socket for tube V7. VS8: Socket for tube V8. VS10: Socket for tube V10. VS11: Socket for tube V11.	
VS9	(*)	(*)	(*)	(*)	(*)	(*)	SOCKET, tube: four 3/16" diam mtg holes on 2 5/16" sq mtg/c; round metal body sq fl, 2 3/4" sq x 2" h; phosphor-bronze silver pl cont; retaining springs; Johnson EF #122–101; Hallicrafters part/dwg #6A344.	Tube socket for V9	2Z8677.24
	(*)	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; 1 1/2" lg x 1/2" wd x .200" thk.	Lock Dzus type fasteners.	2Z8879–38
	(*)	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; approx 1 1/2" lg x 1/2" wd x 7/32" h.	Locks Dzus type fasteners.	6Z3809–13
S3	---	---	---	---	---	(*)	SWITCH, rotary: ea sect 1 pole 7 position; 2 sect; silver pl spring brass cont; phenolic body; 1 3/4" lg x 1 3/4" diam approx o/a; nonshorting type contacts; solder lug term; 3/8" x 32 thd budhing 5/16" lg, 3/4" lg shaft 1/4 in. diam w/3/8" lg flatted sect; fungus resistance; Hallicrafters part/dwg #60B373.	Meter circuit selector	3Z9825–29.24
S3	(*)	(*)	(*)	(*)	(*)	---	SWITCH, rotary: ea sect 1 pole 6 position; 2 sect.	Meter circuit selector	3Z8314.1
S4	---	---	---	(*)	(*)	(*)	SWITCH, rotary: ea sect 2 pole 4 position; 2 sect; silver pl brass cont; bakelite body; 1 3/32" lg x 1 33/64" wd x 1 3/8" h o/a excludin shaft; nonshorting type cont; solder lug term; 3/8" x 32 thd bushing 5/16" lg, 3/4" lg shaft, 1/4" diam w/5/16" lg flatted sect; Hallicrafters part/dwg #60B376.	CARRIER CONTROL	3Z9825–29.25
S4	(*)	(*)	(*)	---	---	---	SWITCH, rotary: ea sect 3 pole, 4 position.	CARRIER CONTROL	3Z9825–55.1
TD2	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, thermostatic: SPST; 10 amp, 110–120 v AC; steel body; 2 3/8" lg x 1 5/8" wd x 1" h o/a; 2 solder lug term; two 5/32" diam mtg holes on 2 1/16" mtg/c; Spencer Thermo #C–4351–17–13; Hallicrafters part/dwg #60A371.	Fan motor control switch	2Z9486–1
TD1	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, thermostatic: SPST; steel body; 1 1/16" lg x 1 5/16" wd x 15/32" h o/a; solder lug term; two .150" diam mtg holes on 1 1/4" mtg/c; Spencer Thermo #B–3120; Hallicrafters part/dwg #60A370.	Crystal temperature control switch.	2Z5022.2
TD3	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, thermostatic: SPST normally open; 30 second time delay; 30 amp at 110 v AC, 20 amp at 220 v AC operating cur phenolic case; 2 1/2" diam x 1 1/4" thk o/a; three .150" diam mtg holes 120 deg apart on 1" rad; Spencer Thermo #ER1; Hallicrafters part/dwg #60A372.	H-v time delay control	2Z7598–10
S1	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, toggle: SPST; JAN ST42A w/JAN STRO1; JAN spec JAN–S–23.	A-c LINE ON—OFF switch	3Z9857.42
S2	(*)	(*)	(*)	(*)	(*)	(*)	SWITCH, toggle: SPST; JAN ST42A; JAN spec JAN–S–23.	HIGH— LOW POWER switch.	3Z9857.42

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
T6	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: pri 500 ohms impedance CT, secd 50,000 ohms impedance; steel case; 3 7/16″ lg x 2 11/16″ wd x 2 15/64″ h o/a; 1½ w operating level; freq response 250 – 15,000 cyc; 5 solder lug term on bottom; six .190″ diam holes on 2.375″ x 7/16″ mtg/c; Chi trans #8821–C; Hallicrafters part/dwg #55B135.	Coupling, audio input to grid of V–1.	2Z9631.242
T10	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, AF: pri 50 ohms impedance, secd 500 ohms impedance; steel case; 2 31/32″ lg x 2 7/16″ wd x 1 57/64″ h o/a; 1½ w operating level; freq response 300 to 3000 cyc; 4 solder lug term on bottom; two .190″ diam mtg holes on 2.125″ mtg/c; Chi Trans #8306–E; Hallicrafters part/dwg #55B136.	Microphone audio input.	2Z9631.243
T12	---	---	---	---	---	(*)	TRANSFORMER, AF: pri 500 ohms impedance, secd 10,000 ohms impedance; steel case; 2⅞″ lg x 2¼″ wd x ½″ h o/a; turns ratio 1 to 4.6; freq response 300 to 3000 cyc 1 db; 4 solder lug term on bottom; two .187″ wd slotted mtg holes on fl on 1.9375″ mtg/c; Chi Trans #14734; Hallicrafters part/dwg #55B140.	Voltage step-up microphone circuit.	2Z9631.402
T7	(*)	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, power: input 115 v, 50–60 cyc, single ph; 3 output wnd; secd #1, 33 v at .15 amp; secd #2, 6.3 v at .0 amp CT; secd #3, 5.0 v at 4.0 amp CT; breakdown voltage 1750 v; HS metal case; 4 19/64″ h x 3 9/32″ wd x 3 21/32″ lg excluding term and fl; 10 solder lug term on bottom; six .220″ diam mtg holes on fl on 3.875″ x 1.375″ mtg/c; Chi trans #1348 1–A; Hallicrafters part/dwg #52C192.	Filament and selenium rectifier a-c supply.	2Z9611.298
T8	---	---	---	---	---	(*)	TRANSFORMER, power: input 115 v AC, 50/60 cyc, single ph; pri extended to provide 600 v AC output; 1 secd wnd, CT; secd, 700–0–700 v AC at .300 amp CT; breakdown voltage, pri 2500 secd 4000; HS metal case; 6 1/16″ lg x 5⅞″ wd x 5 5/16″ h excluding term; 6 screw type term on bottom; six .270″ diam mtg holes on fl on 5.375″ x 1.750″ mtg/c; Chi Trans #15677; Hallicrafters part/dwg #52C220.	Plate supply for V10 and V11.	2Z9612.321
T8	(*)	(*)	(*)	(*)	(*)	---	TRANSFORMER, power: plate type; input 115 v 50/60 cyc, single ph, w/top; 1400 v CT, 260 ma, HS steel case.	Plate supply for V110 and V11.	2Z9612.3
T5	(*)	(*)	(*)	---	---	(*)	TRANSFORMER, RF: 2 wnd, space wnd; unshielded; pri 2 turns #18 copper wire, secd 1½ turns #14 copper wire w/CT; 2⅞″ lg x 1″ wd x 1¼″ h approx o/a; 1 solid lucite coil form, 1 hollow lucite spacing collar; pri form ½″ OD x 1″ lg, secd form ⅝″ OD x ½″ lg; two .156″ diam mtg holes on 2 5/16″ mtg/c; 5 tinned wire lead term; Hallicrafters part/-dwg #51B1165.	Couples V8 plate to p-a (V9) grids. Couples V8 plate to p-a grids.	3C1084G–4 3C4018–3

Ref symbol	Models A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
T1	(*)	(*)	(*)	---	---	---	TRANSFORMER, RF: 2175–3150 kc; 2 wnd, universal wnd; rectangular aluminum shield can; pri 67 turns, secd $68\frac{1}{2}$ turns #7–41 Litz wire; $4\frac{1}{8}''$ lg x 2″ wd x $1\frac{7}{16}''$ thk; solid lucite coil form; form $\frac{1}{2}$in. OD x $1\frac{1}{2}''$ lg; 2 built in var capacitors; scdr adj at top of can; fungus resistance; Hallicrafters part/dwg #50C433.	Couples V4 plate to V5 grid.	2Z9629–50
T1	---	---	---	(*)	(*)	(*)	TRANSFORMER, RF: 2 wnd, universal wnd; rectangular aluminum shield 4″ lg x 2″ wd x $1\frac{7}{16}''$ d; lucite form air core; 2 built in trimmers; 3 fixed capacitors and 2 resistors; scdr adj on top of can.	Couples V4 plate to V5 grid.	3C323–34Z7
T11	---	---	---	(*)	(*)	---	TRANSFORMER, RF: 2 wnd, single ph, universal wnd; rectangular aluminum shield; 4″ lg x 2″ wd x $1\frac{7}{16}''$ d; lucite form air core; 2 built in trimmers; 2 fixed capacitors and 1 resistor; scdr adj at top.	First doubler plate tuning.	3C323–34Z4
T2	(*)	(*)	(*)	---	---	(*)	TRANSFORMER, RF: tuning range 8700–13,000 kc; single wnd, single layer wnd; rectangular aluminum shield can; 31 turns #24 E copper wire; $4\frac{1}{8}''$ lg x $1\frac{7}{8}''$ wd x $1\frac{7}{16}''$ thk; solid lucite coil form $\frac{1}{2}''$ OD x 2″ lg; 1 built in var capacitor; scdr adj at top of can; 5 solder lug term; ins RMA color-coded leads $3\frac{1}{2}''$ and $2\frac{3}{4}''$ lg attached to terms 1 and 2; 2″ lg #20 bare wire attached to term 4; fungus resistance; Hallicrafters part/dwg #50C434.	V5 plate tuning	2Z9629–51
T3	---	---	---	---	---	(*)	TRANSFORMER, RF: 17.5–25 mc; 2 wnd, single layer wnd; rectangular aluminum shield can; ea wnd $12\frac{1}{2}$ turns of #24 E copper wire; $4\frac{1}{8}''$ lg x 2″ wd x $1\frac{7}{16}''$ thk; solid lucite coil form $\frac{1}{2}$ in. OD x 2″ lg; 2 built in var capacitors; scdr adj top of can; 7 solder lug term; fungus resistance; Hallicrafters part/dwg #50C435.	Couples V6 plate to V–7 grid.	2Z9629–52
T4	---	---	---	---	---	(*)	TRANSFORMER, RF: tuning range 35–50 mc; 2 wnd, space wnd; rectangular aluminum shield can; pri 5 turns, secd $4\frac{3}{4}$ turns #22 E copper wire; $4\frac{1}{8}''$ lg x 2″ wd x $1\frac{7}{16}''$ thk; solid lucite coil form $\frac{1}{2}$ in. OD x 2″ lg; 2 built in var capacitors; scdr adj top of can; fungus proof; Hallicrafters part/dwg #5C-436.	Couples V7 plate to V8 grid.	2Z9629–53
V1	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN type 6SN7GT	Crystal oscillator and audio amplifier.	2J6SN7GT
V2	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN type 6AC7	Oscillator amplifier	2J6AC7
V3	---	---	---	---	---	(*)	TUBE, electron: JAN type 6SL7GT	V3: Phase modulator and VTVM.	2J6SL7GT
	(*)	(*)	(*)	---	---	---		V3: Phase modulator	
	---	---	---	(*)	(*)	---		V3: Phase modulator and 1st doubler.	
V4	(*)	(*)	(*)	(*)	(*)	(*)	TUBE, electron: JAN type 6AC7.	Frequency tripler	2J6AC7
V5 thru V8	(*)	(*)	(*)	---	---	(*)	TUBE, electron: JAN type 6V6GT/G	V5: Frequency quadrupler.	2J6V6GT/G
	---	---	---	(*)	(*)	---		V5: Second frequency doubler.	
	(*)	(*)	(*)	---	---	(*)		V6: First frequency doubler.	

8. Identification Table of Parts for Radio Transmitter T-14(*)/TRC-1—(Continued)

Ref symbol	A	B	C	D	E	H	Name of part and description	Function of part	Signal Corps stock No.
	---	---	---	(*)	(*)	---		V6: Third frequency doubler.	
	(*)	(*)	(*)	---	---	(*)		V7: Second frequency doubler.	
	---	---	---	(*)	(*)	---		V7: Fourth frequency doubler.	
	(*)	(*)	(*)	---	---	(*)		V8: Third frequency doubler.	
	---	---	---	(*)	(*)	---		V8: Fifth frequency doubler.	
V9	(*)	(*)	(*)	(*)	(*)	(*)	TUBE: electron; JAN-829B; push-pull r-f beam power amplifier.	Power amplifier	2J829B
V10,	(*)	(*)	(*)	(*)	(*)	(*)	TUBE: electron; JAN type 5RYGY	Rectifier	2J5RYGY
V11	(*)	(*)	(*)	(*)	(*)	(*)			

9. Identification Table of Parts for Amplifier AM-8(*)/TRA-1

(U) equals unlettered model.

Ref symbol	(U)	A	B	C	D, E	Name of part and description	Function of part	Signal Corps stock No.
	---	---	---	---	---	AMPLIFIER, RF: Army-Navy Amplifier AM-8(*)/TRA-1; 70 to 100 mc; output 250 w; 12¼″ lg x 19¼″ wd x 11¼″ h; operates from Army-Navy Power Supply PP-13D/TRA-1; p/o Army-Navy Amplifier Equipment AN/TRA-1D.	Power amplifier for Radio Set AN/TRC-1(*).	
FM201	(*)	(*)	(*)	(*)	(*)	BLOWER, centrifugal vane: electric motor operated; guarded; motor 115 v AC 60 cycle single ph, 40 w; Delco Appco type #2371.	Cooling blower	3H404-1
	(*)	(*)	(*)	(*)	(*)	CAP: receptacle cover; u/w Amphenol type AN-3102-18-16P receptacle; aluminum; w/ aluminum chain 3 17/32″ lg; cap 1¼″ OD x 7/16″ lg w/internal 1⅛″ -18 thd; type #AN-9760-18.	H-v input receptacle cover cap.	2Z1612.2
	(*)	(*)	(*)	(*)	(*)	CAP: receptacle cover; u/w Amphenol type SO-239 receptacle; aluminum; w/aluminum chain 2″ lg; cap ¾″ OD x 7/16″ lg w/internal ⅝″ -24 thd; type #AN-9760-10.	R-f input, receiver antenna input, and amplifier output cover cap.	2Z3351-30
	(*)	(*)	(*)	(*)	(*)	CAP: receptacle cover; u/w Amphenol type AN-3102-28-19P receptacle; aluminum; w/ aluminum chain 4″ lg; cap 1⅞″ OD x ½″ lg w/internal 1¾″ -18 thd; type #AN-9760-28.	Power input cover cap	2Z1607-10
C201	(*)	(*)	(*)	(*)	(*)	CAPACITOR, variable: air dielectric; plate meshing type, dual sect; 5.5-50 uuf per sect; Teleradio Eng #AP-12-3. (minimum 3 uuf in unlettered through D models.)	GRID TUNING	3D9050V-64
C202 thru C205	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica; 5100 uuf ±5%; 500 vdcw; JAN type CM40B512J.	C202: Grid resistor bypass. C203: Grid resistor bypass. C204 and C205: Amplifier filament r-f bypass.	3K4051222
C206,	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica; 2000 uuf ±5%; 1200 vdcw; JAN type CM45B202J.	Screen grid r-f bypass	3K4520222
C207	(*)	(*)	(*)	(*)	(*)			
C208	(*)	(*)	(*)	(*)	(*)	CAPACITOR, variable: air dielectric; plate meshing type, dual sect; 7-35 uuf per sect; Johnson EF #35-ED-45. (6-30 uuf in unlettered model).	Amplifier PLATE TUNING.	3D9035V-26

Ref symbol	Model					Name of part and description	Function of part	Signal Corps stock No.
	(U)	A	B	C	D, E			
C209	(*)	(*)	(*)	(*)	(*)	CAPACITOR, variable: air dielectric; plate meshing type, single sect; 5–52 uuf; Johnson EF #50–G–20 (5–50 uuf in unlettered through D model).	ANTENNA LOADING control.	3D9032V–1
C210	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica; 25 uuf; ±20%; 500 vdcw; JAN type CM30B252M (24 uuf in D model).	R-f input coupling and primary resonating.	3D9025–40
C211	(*)	(*)	(*)	(*)	(*)	CAPACITOR, fixed: mica; 2000 uuf ±5%; 500 vdcw; JAN type CM30B202J.	Meter r-f bypass	3K3020222
	(*)	(*)	(*)	(*)	(*)	CLEANER ELEMENT, air: fiberglass; rectangular $8\frac{1}{2}$″ lg x $4\frac{3}{4}$″ wd x $\frac{1}{2}$″ thk.	Air filter	6Z3856–67.1
L201[1]	(*)	(*)	(*)	(*)	---	COIL, RF: input coupling; 1 turn #12 copper wire; $\frac{3}{4}$″ ID; air core.	R-f input primary	
L202[1]	(*)	(*)	(*)	(*)	(*)	COIL, RF: grid tuning; 4 turns space wound #12 copper wire, ct; $\frac{3}{4}$″ ID; air core; self-supporting solenoid.	R-f input secondary	
L203[1]	(*)	(*)	(*)	(*)	(*)	COIL, RF: plate tuning; 3 turns space wound $\frac{3}{8}$″ copper tubing, ct; $1\frac{1}{2}$″ ID; air core; self-supporting solenoid.	R-f output tank (primary).	
L204[1]	(*)	(*)	(*)	(*)	---	COIL, RF: antenna coupling; 1 turn $\frac{3}{16}$″ copper tubing; $1\frac{1}{4}$″ ID; air core; self-supporting solenoid.	R-f output coil (secondary).	
L205	(*)	(*)	(*)	(*)	(*)	COIL, RF: plate choke; single wnd, single layer wnd; 30 turns close wnd, #22 E copper wire; 18 of wnd 1″ on $\frac{1}{4}$″ diam x $1\frac{3}{8}$″ lg ceramic form; mtg lugs on ea end; Emerson Rad #SK–T–206.	Amplifier plate r-f choke	3C342–14
P201, P202, P203	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	CONNECTOR, female contact: Sig C Socket SO–239; round single cont; straight; 1″ sq x $1\frac{1}{16}$″ lg; four .120″ diam holes on $\frac{23}{32}$″ x $\frac{23}{32}$″ mtg/c; Amphenol type #83–1R.	P201: R-F INPUT coupling. P202: RECEIVER antenna coupling. P203: Amplifier output ANTENNA coupling.	2Z8799–239
P204	(*)	(*)	(*)	(*)	(*)	CONNECTOR, male contact: Sig C Socket SO–131; four #12 and six #16 round pol cont; straight; 2″ sq x $1\frac{11}{32}$″ lg; four .147″ diam holes on $1\frac{9}{16}$″ x $1\frac{9}{16}$″ mtg/c.	POWER INPUT cable plug.	2Z8799–131
P205	(*)	(*)	(*)	(*)	(*)	CONNECTOR, male contact: Sig C Socket SO–204; single round cont; straight; four .120″ diam holes on $1\frac{1}{16}$″ x $1\frac{1}{16}$″ mtg/c.	HIGH-VOLTAGE CABLE input.	2Z8799–204
	(*)	(*)	(*)	(*)	(*)	FASTENER: Dzus; shaft $\frac{5}{16}$″ dia under cut .125″ below head, .35″ from head to cam, w/ grommet GA5–312, aluminum, .312″ lg x $\frac{3}{8}$″ OD w/.028″ wall.	To fasten panels to amplifier chassis.	6Z3809–9.1
	---	(*)	(*)	(*)	(*)	FASTENER: Dzus; wing type; head $1\frac{1}{8}$″ lg x $\frac{7}{16}$″ h x .062″ thk; shaft $\frac{5}{16}$″ dia under cut .125″ below head; .35″ from head to cam; w/Dzus GA–5–312 aluminum grommet; .312″ lg x $\frac{3}{8}$″ OD w/.028″ wall thk.	To fasten panels to amplifier chassis.	6Z3809–3.1
	---	(*)	(*)	(*)	(*)	FASTENER: Dzus; wing type; w/cam slot; wing $1\frac{1}{4}$″ lg x $\frac{7}{16}$″ h, shank $\frac{3}{8}$″ dia x .400″ lg under head to cam slot w/Dzus #GA6–350 aluminum grommet $\frac{7}{16}$″ OD x .350″ lg.	To fasten panels to amplifier chassis.	6Z3809–14
	---	(*)	(*)	(*)	(*)	INSULATOR, feedthru: conical shape; JAN type NP2W4103 and JAN type NP2W4203; per spec JAN–1–21.	H-v feed	3G290–21
	---	(*)	(*)	(*)	(*)	INSULATOR, feedthru: conical shape; JAN type NP2W4101 and JAN type NP2W4201; per spec JAN–1–21.	Grid feedthrough for neutralizing.	3G290–20

[1] Coils L201 through L204 will be replaced by hand-wound wire coils when necessary.

Ref symbol	Model (U)	A	B	C	D, E	Name of part and description	Function of part	Signal Corps stock No.
	---	(*)	(*)	(*)	(*)	INSULATOR, stand-off: round post shape; JAN type NP2W0308; per spec JAN-1-21.	Supporting	3G3503-08.1
	---	(*)	(*)	(*)	(*)	INSULATOR, stand-off: round post shape; JAN type NP2W0206; per spec JAN-1-21.	Supporting	3G1250-12.6
	---	---	---	---	(*)	INSULATOR, stand-off: round post shape; JAN type NP2W0212; per spec JAN-1-21.	Supporting	3G3502-12.1
	---	(*)	(*)	(*)	(*)	KNOB: bar; black bakelite; for 1/4″ diam shaft; w/single #8-32 set screw; white engraved line on pointer; 1 1/4″ lg x 5/8″ h x 5/8″ rod; shaft hole 1/2″; Harry Davies Mold #2300A.	Meter switch	2Z5838
	---	(*)	(*)	(*)	(*)	KNOB: round; black bakelite; for 1/4″ diam shaft; w/single #10-32 set screw; indicator line engraved on skirt; 1 1/2″ diam of skirt x 13/16″ h o/a; w/brass insert; shaft hole 41/64″; finger grip fluted knob; Kurz-Kasch #S-380-64L.	Tuning	2Z5822-68
PL201, PL202	(*) ---	(*) (*)	(*) (*)	(*) (*)	(*) (*)	LAMP, incandescent: 115 v, 6 w; bulb S-6 clear; 2″ max lg o/a; candelabra screw base; tungsten fil; burn any position; Mazda #6S6.	PL201: FILAMENT on-off indicator. PL202: PLATE voltage on-off indicator.	2Z5886
	(*)	(*)	(*)	(*)	(*)	LENS, indicator light: green; thd type; smooth clear glass 1/2″ diam; bezel 3/4″ diam x 1/2″ lg shank; o/a dimen 15/16″ h x 3/4″ hex; p/o Gothard #1021 indicator lamp assembly; Gothard #423.	Filament indicator lamp lens.	2Z6125-9
	(*)	(*)	(*)	(*)	(*)	LENS, indicator light: red; thd type; smooth clear glass 1/2″ diam; bezel 3/4″ diam x 1/2″ lg shank; o/a dimen 15/16″ h x 3/4″ hex; p/o Gothard #1021 indicator lamp assembly; Gothard #423.	Plate voltage indicator lamp lens.	2Z6125-10
P/o PL201 PLS201	(*)	(*)	(*)	(*)	(*)	LIGHT: indicator; w/lens; 1/2″ dia green smooth jewel; candelabra screwbase for S6 bulb.	Filament indicator lamp	2Z5884-57
P/o PL202 PLS202	(*)	(*)	(*)	(*)	(*)	LIGHT: indicator; w/lens; 1/2″ dia red smooth jewel; candelabra screw base for S6 bulb.	Plate voltage indicator	2Z5884-58
M201	---	---	---	(*)	---	METER, ammeter: DC; 0 to 3 ma; JAN type MR24S111SPEC.	Grid current, plate current, and plate voltage indicator.	3F893-5
M201	---	---	---	---	(*)	METER, ammeter: DC, 0 to 3 ma; JAN type MR26S167SPEC.	Grid current, plate current, and plate voltage indicator.	3F893-8
M201	---	(*)	-	---	---	METER: multiscale; DC; 0 to 30/450 ma; 0 to 3 kv.	Grid current, plate current, and plate voltage indicator.	3F6299-3
M201	---	---	(*)	--	---	METER: multiscale; DC; 0 to 30/450 ma; 0 to 3 kv.	Grid current, plate current, and plate voltage indicator.	3F6318
	(*)	(*)	(*)	(*)	(*)	MOUNT: vibration; sq shape; 2 3/8″ sq x 1 1/16″ h o/a.		2Z8404-2
RL201	(*)	(*)	(*)	(*)	(*)	RELAY, armature: DPDT; cont rating 15 amp at 6 v; silver cont 3/16″ diam; coil 12 v DC, ins; solder lug term on coil and cont; 2 3/4″ lg x 1 1/2″ wd x 1 3/4″ thk; two #6-32 holes on 1 7/16″ mtg/c; fast acting; Adv Elec #2000.	Antenna transfer	2Z7590-17
R201, R202	(*) ---	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: WW; 10,000 ohms ±5%; 4 w; body 1 3/4″ lg x 5/16″ OD; cement coating; 2 solder lug term; IRC type AB.	Grid bias	3Z6610-328
R203	---	---	---	(*)	(*)	RESISTOR, fixed: WW; .167 ohm ±1%; 1/3 w; JAN type RB11BR1670F (.22 ohms in unlettered model).	Amplifier plate current meter shunt.	3RB1-1670

Ref symbol	Model (U)	A	B	C	D, E	Name of part and description	Function of part	Signa Corps stock No.
R203	---	(*)	(*)	---	---	RESISTOR, fixed: WW; .15 ohm ±1%; 1/3 w; JAN type RB11BOR1500F.	Amplifier plate current meter shunt.	3RB1–1500
R204	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 510,000 ohms ±5%; 1 w; JAN type RC30BF514J (500,000 ohms in unlettered through C models).	Screen voltage bleeder	3RC30BF514J
R205, R213	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	RESISTOR, fixed: WW; 630 ohms ±5%; 8 w; JAN type RW30F631 (600 ohms in unlettered through C models).	R205: Filament indicator lamp dropping. R213: Plate voltage indicator lamp dropping.	3RW23135
R207	(*)	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 1000 ohms ±10%; 1 w; JAN type RC30BF102K.	Plate voltage meter shunt	3RC30BF102K
R208 thru R212	---	(*)	(*)	(*)	(*)	RESISTOR, fixed: comp; 200,000 ohms ±1%; 2 w; 1 3/4″ lg x 9/32″ diam; ins, impr f/tropical use; axial wire leads 1 1/2″ lg; Concarbon type #X–2.	Plate voltage meter multiplier.	3Z6720–34
R206	---	(*)	---	---	---	RESISTOR, fixed: WW: 2.25 ohms ±1%; 1/4 w; JAN type RB10B2R250F.	Amplifier grid current meter shunt.	3RB2–2250
R206	---	---	(*)	---	---	RESISTOR, fixed: WW; 2.5 ohms ±1%; 1/3 w; JAN type RB11B2R500F.	Amplifier grid current meter shunt.	3RB2–2500
R206	---	---	---	(*)	(*)	RESISTOR, fixed: WW; 3.7 ohms ±1%; 1/3 w; JAN type RB11B3R700F.	Amplifier grid current meter shunt.	3RB2–3700
VS201, VS202	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	SOCKET, tube: 7 cont giant; above or under chassis wafer mtg; four .174″ diam holes on 1 7/8″ x 1 7/8″ mtg/c; sq ceramic body 2 5/8″ x 2 5/8″ x 9/16″ h; cadmium pl cont; Johnson EF type #237.	Power amplifier tube socket.	2ZK8677.18
VS203, VS204, VS205	(*) --- ---	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	SOCKET, tube: 8 prong med; 1 piece saddle mtg; 2 mtg slots 1/8″ x 1/4″ on 1 1/2″ mtg/c; 15/32″ diam chassis cut-out required; round mica filled bakelite body; silver cont; Amphenol type #M1P8TM.	Screen voltage regulator tube socket.	2Z8678.289
	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; approx 1 1/2″ lg x 1/2″ wd x 7/32″ h.	Locks Dzus type fastener	6Z3809–13
	(*)	(*)	(*)	(*)	(*)	SPRING: loop type; 1 1/2″ lg x 1/2″ wd x .200 thk at ends	Locks Dzus type fastener	2Z8879–38
TD201	(*)	(*)	(*)	(*)	(*)	SWITCH, thermostatic: SPST; closes at 85° F, opens at 75° F; 110 to 120 v AC; flanged rectangular metal case 1 5/8″ wd x 2 3/8″ lg x 13/32″ h; screw term; two 5/32″ diam mtg holes on 2 1/16″ ctrs; Spencer Thermo type #C–4351–17.	Ventilator fan control	3H4674B.1/T4
S201	(*)	(*)	(*)	(*)	(*)	SWITCH, rotary: 2 pole, 3 position; single sect; phosphor bronze silver pl cont; o/a diam 1 1/4″ base diam, shaft 2″ lg x .249″ diam w/3/8″ x 3/8″–32 bushing; nonshorting type; lug term; Mallory type #3223J.	Circuit selection METER SWITCH.	3Z9693–4
S202	(*)	(*)	(*)	(*)	(*)	SWITCH, toggle: DPST; 6 amp, 250 v; black bakelite case; 1 7/8″ lg x 13/16″ wd x 25/32″ h; 21/32″ lg bat handle; screw term w/jumper ea end; single hole mtg bushing 15/32″–32, 15/32″ lg; radioactive indicating lever; C-H type #7320–K2.	Filament voltage OFF-ON switch.	3Z9863–50K
S203, S204	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	SWITCH, toggle: DPST; 6 amp, 250 v; black bakelite case; 1 7/8″ lg x 13/16″ wd x 25/32″ h; 21/32″ lg bat handle; screw term w/jumper ea end; single hole mtg bushing 15/32″–32, 15/32″ lg; radioactive indicating lever; C-H type #7320–K2.	S203: Plate voltage OFF-ON switch. S204: TUNE-OPERATE power dropping switch.	3Z9508
S205	---	---	(*)	(*)	(*)	SWITCH, sensitive: SPST; 5 amp, 250 v; black bakelite case; 1 15/16″ lg x 11/16″ wd x 53/64″ h; screw term; two .139″ diam mtg holes on 1″ mtg/c; Micro Sw type #Y–Z–RL2.	Door safety interlock	3Z9558–39.25
S205	(*)	(*)	---	---	---	SWITCH: push; SPST; normally open	Door safety interlock	3Z9824–53

9. Identification Table of Parts for Amplifier AM-8(*)/TRA-1—(Continued)

Ref symbol	Model (U)	A	B	C	D, E	Name of part and description	Function of part	Signal Corps stock No.
T201	---	---	---	---	(*)	TRANSFORMER, power: fil type; input 115 v, 50 to 60 cyc; single output wnd; output 5 v CT, 15 amp; HS metal case; 5 5/16″ lg x 5 1/4″ h x 4 1/2″ wd; five #8-32 stud term spaced 5/8″ apart on top; four 15/64″ diam mtg holes on 2 1/2″ x 4 3/4″ ctrs; Chicago Trans #8218B.	Power amplifier tube filament transformer.	2Z9611.625
T201	(*)	(*)	(*)	(*)	(*)	TRANSFORMER, power: fil type; input 115 v, 50 to 60 cyc; single output wnd output 5 v CT, 15 amp; HS metal case; 5 5/16″ lg x 5 1/4″ h x 4 1/2″ wd; five #8-32 stud term spaced 5/8″ apart on top; four 15/64″ diam mtg holes on 2 1/2″ x 4 3/4″ ctrs; Chicago Trans #8218B.	Power amplifier tube filament transformer.	2Z9611.295
V201, V202	(*) (*)	(*) (*)	(*) (*)	(*) (*)	(*) (*)	TUBE, electron: JAN-4E27; pentode	Power amplifier	2J4E27
V203, V204, V205	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	(*) (*) (*)	TUBE, electron: JAN-OD3; voltage regulator	Screen voltage regulator	2JOD3

10. Identification Table of Parts for Power Supply PP-13(*)/TRA-1

Ref symbol	Model Unlettered Through C	Early D	Late D and E	Name of part and description	Function of part	Signal Corps stock No.
			(*)	POWER SUPPLY PP-13(*)/TRA-1; electronic type; output 115 v, 50/60 cyc, 175 w, —120 DC, 450 v DC, 40 ma, 1900 v DC, 250 ma; input 115 v, 50/60 cyc; 13 1/4″ lg x 26 1/2″ wd x 9 1/2″ h; uses 2 type 866/866A and 1 type 6X5GT tubes; full wave; filtered; p/o Army-Navy Amplifier Equipment AN/TRA-1D.	Power supply for Amplifier. AM-8(*)/TRA-1.	3H4497-13
FM301	(*)	(*)	(*)	BLOWER: motor 1/100 hp, 3100 rpm, 60 cyc, single ph, 110 v AC; 60-70 cfm at 3100 rpm.	---	3H404-1
PC301	(*)	(*)	(*)	CABLE ASSEMBLY, power: two #12 AWG stranded cond, 13 ft lg.	A-c power input cable.	3E3161-7
PC302	(*)	(*)	(*)	CABLE ASSEMBLY, special purpose: five #18, three #14, and two #12 stranded cond; 40″ lg.	Power supply output cable.	3E3161-5
PC303	(*)	(*)	(*)	CABLE ASSEMBLY, special purpose: single #18 AWG stranded cond; 40″ lg.	High-voltage output cable.	3E3161-6
C301, C302	(*) (*)	(*) (*)	(*) (*)	CAPACITOR, fixed: electrolytic; 2 sect; 10-10 uf; 450 vdcw; JAN type CE52F 100R (20 uf in B and C models).	Bias supply filter	3DB10-172
C303	(*)	(*)	(*)	CAPACITOR, fixed: paper; 2 uf ±10%; 2500 vdcw; JAN type CP70E1FK205K.	High-voltage filter	3DB2-185
	(*)	(*)	(*)	CLEANER ELEMENT, air: fiber glass; one time; Owens-Corning.	Air filter	6Z3856-67.1
	(*)	(*)	(*)	CLIP: electron tube; plate cap; ceramic, Millen cat. #36001.	High-voltage tube plate connections.	2Z2725.2
	(*)	(*)	(*)	CONNECTOR, receptacle: female contact; straight; GE type #9402.	Tuning resistor socket.	6Z8353
P303	(*)	(*)	(*)	CONNECTOR, plug: 2 parallel blade male cont; straight type.	For A-C line plug	6Z1734.5

Ref symbol	Model: Unlettered Through C	Model: Early D	Model: Late D and E	Name of part and description	Function of part	Signal Corps stock No.
P301	(*)	(*)	(*)	CONNECTOR, female contact: standard twin convenience outlet; 4 rectangular female cont; straight; GE type #2679.	Convenience 115V 60 CYCLE OUTLET receptacle.	6Z7786–1
P302	(*)	(*)	(*)	CONNECTOR, female contact: 10 round cont pol; right angle.	Main outlet for bias and high voltage.	2Z8680.3
P304	(*)	(*)	(*)	CONNECTOR, male contact: four round pol cont; straight; Amphenol #PM4–7.	Plug between bias and high-voltage rectifiers.	2Z7114.6
P306	(*)	(*)	(*)	CONNECTOR, plug: Sig C Plug PL–Q244; 1 round female pol cont; right angle type.	-------------------	2Z7226–Q224
				FASTENER, Dzus: wing type; head 1⅛″ lg x 7/16″ h x .062″ thk; shaft 5/16″ dia undercut .125″ below head, .35″ from head to cam.	-------------------	6Z3809–3.1
F301, F302	(*) (*)	(*) (*)	(*) (*)	FUSE, plug: 15 amp, 125 v; one time; GE type #PY–15.	F301: OUTLET FUSE. F302: AMPLIFIER power line FUSE.	3Z2015–4
F303	(*)	(*)	(*)	FUSE, cartridge: ⅜ amp, 250 v; one time; Littelfuse #1045–A. (Original value ¼ amp in unlettered through E models.)	High-voltage fuse in negative return.	3Z2588.1
FS303	(*)	(*)	(*)	FUSEHOLDER: extractor post type; one 3AG fuse; Littelfuse type #1075.	High-voltage fuse-holder.	3Z3275
H301, H302	(*) (*)	(*) (*)	-------- --------	HEATING ELEMENT, electrical: tubular type; 110 v, 100 w; single sect; Emerson Rad #SK–R–673. (Not used in unlettered model.)	High-voltage rectifier heater.	2Z5017
R304	(*)	(*)	(*)	HEATING ELEMENT, electrical: cone type; 115 v, 660 w; single sect; GE Glocoil type #415A. (Not used in unlettered and A models.)	Tuning load dropping.	2Z5016–4
	(*)	(*)	(*)	INSULATOR, stand-off: round post shape; JAN type NS4W0308.	-------------------	3G3503–08.1
	(*)	(*)	(*)	INSULATOR, stand-off: round post shape; JAN type NS4W0206.	-------------------	3G3502–06.2
FS301, FS302	(*) (*)	(*) (*)	(*) (*)	LAMPHOLDER: female contact; std lampholder screw base receptacle; GE type #172.	FS301: Outlet fuse holder. FS302: Power supply main line fuse holder.	6Z7807–5
CH301	(*)	(*)	(*)	REACTOR: 6 hy, 50 ma; HS metal case; Emerson Rad #SK–T–212.	Bias filter choke-----	3C323–56C
CH302	(*)	(*)	(*)	REACTOR: 12 hy, 300 ma; HS metal case; Emerson Rad #SK–T–210.	High-voltage filter choke.	3C317–16
TD301	(*)	(*)	(*)	RELAY, time delay: SPST; cont rating 110 v, 30 amp thermal operated; Spencer Thermo type #ER–1.	High-voltage time delay.	2Z7598–10
R301	--------	(*)	(*)	RESISTOR, fixed: WW; 2500 ohms ±5%; 8 w; JAN type RW29F252.	Bias supply voltage dividing and filter resistor.	3RW26751
R301	(*)	--------	--------	RESISTOR, fixed: WW; 2500 ohms ±10%; 10 w; JAN type.	Bias supply voltage divider and filter resistor.	3Z6250–66
R302	(*)	(*)	(*)	RESISTOR, fixed: WW; 3100 ohms ±12%; 8 w; JAN type (3000 ohms in unlettered through E models).	Bias supply bleeder--	3RW27323

Ref symbol	Model: Unlettered Through C	Model: Early D	Model: Late D and E	Name of part and description	Function of part	Signal Corps stock No.
R303	--------	(*)	(*)	RESISTOR, fixed: WW; 35,000 ohms ±5%; 116 w; JAN type RW11F353.	Screen series voltage regulating and high-voltage bleeder.	3RW33602
R303	(*)	--------	--------	RESISTOR, fixed: WW; 35,000 ohms ±10%; 100 w; JAN type.	Screen series voltage regulating and high-voltage bleeder.	3Z6635-22
R305	--------	(*)	(*)	RESISTOR, fixed: WW; 25,000 ohms ±5%; 60 w; JAN type RW36F253.	Screen voltage divider and high-voltage bleeder.	3RW32715
R305	(*)	--------	--------	RESISTOR, fixed: WW; 25,000 ohms ±10%; 20 w; JAN type.	Screen voltage divider and high-voltage bleeder.	3Z6625-99
VS301	(*)	(*)	(*)	SOCKET, tube: octal; one piece saddle mtg; phosphor bronze silver pl cont; Amphenol type #MIP-8T.	Socket for bias rectifier.	2Z8678.74
VS302, VS303	(*) (*)	(*) (*)	(*) (*)	SOCKET, tube: 4 cont jumbo bayonet type; wafer mtg; phosphor bronze cont; Johnson EF type #210.	Socket for high-voltage rectifier.	2Z8756.2
P305	(*)	(*)	(*)	SOCKET, tube: 4 cont med; one piece saddle mtg; phosphor bronze silver pl cont; Amphenol type #MIP-4T.	Socket between bias and high-voltage rectifiers.	2Z8659-5.1
	(*)	(*)	(*)	SPRING: loop type; .080″ dia music wire, steel; 1½″ lg x ½″ wd x .200″ thk at ends.	Lock Dzus type fasteners.	2Z8879-38
TD303	(*)	(*)	--------	SWITCH, thermostatic: SPST; opens at 55° F, closes 65° F; Spencer Thermo #C-4351-18.	Low-temperature control; opens circuit when power supply is too cold for safe operation.	3H4674B.1/T3
TD304	(*)	(*)	--------	SWITCH, thermostatic: SPST; closes at 70° F, opens at 80° F; Spencer Thermo #C-4351-18 (Omitted in unlettered model).	Tube heater control--	3H4674B.1/T2
TD302	(*)	(*)	(*)	SWITCH, thermostatic: SPST; opens at 75° F, closes at 85° F; Spencer Thermo type #C-4351-17.	Blower control------	2Z9486-1
S301	(*)	(*)	--------	SWITCH, interlock: SPST; c/o 2 parts, frame sect and door sect. (Not used in A through C models.)	Safety interlock-----	3Z9560-7
S301	(*)	--------	(*)	SWITCH, sensitive: SPST; 10 amp 110/220 v AC or DC; GE #7460330G4. (Not used in unlettered model.)	Safety interlock-----	3Z955839.22
T301	(*)	(*)	(*)	TRANSFORMER, power: fil and plate type; input 115 v, 50-60 cyc; 2 output wnd; secd #1, 488 v CT .095 amp; secd #2, 6.3 v, .62 amp; HS metal case; Emerson Rad #SK-T-211.	Bias supply filament and plate.	2Z9612.150
T302	--------	(*)	(*)	TRANSFORMER, power: plate type; input 115 v, 50-60 cyc; output 4700 v at 300 ma CT; HS metal case.	High-voltage plate---	2Z9612.256
T302	(*)	--------	--------	TRANSFORMER, power: plate type; input 115 v, 50-60 cyc; 1 output wnd; output 4700 v CT, 300 ma; encl metal case; Emerson Rad #SK-T-208.	High-voltage plate---	2Z9612.149

10. Identification Table of Parts for Power Supply PP–13(*)/TRA–1—(Continued)

Ref symbol	Model: Unlettered Through C	Model: Early D	Model: Late D and E	Name of part and description	Function of part	Signal Corps stock No.
T303	(*)	(*)	(*)	TRANSFORMER, power: fil type; input 115 v 50–60 cyc; 1 output wnd; output 2.5 v CT, 15 amp; HS metal case; Emerson Rad #SK–T–209.	High-voltage filament.	2Z9611.296
V301	(*)	(*)	(*)	TUBE, electron: JAN–6X5GT/G; rectifier	Bias rectifier	2J6X5GT
V302, V303	(*) (*)	(*) (*)	(*) (*)	TUBE, electron: JAN–866A/866; rectifier	High-voltage rectifier.	2J3B28

JAN 3B28 tubes used in late D and E model.

11. Identification Table of Parts for Antenna Support AB–33(*)/TRC–1

Figure	Name of part and description	Function of part	Signal Corps stock No.
5, 17	ANTENNA SUPPORT AB–33B/TRC–1: mtg for Antenna AS–20( )/TRC–1; c/o Mast Sections AB–101/TRC–1, Guy Plates MX–552/TRC–1, Guys MX–555/U, Mast Base AB–102/TRC–1, and other aux parts; Hallicrafters part #117X017.	Supports antenna	2A248–33B
	AXE LC–1: tool steel; 1¾ lb head; 15¼″ to 16¼″ max lg handle w/5⅞″ lg head; Bredemann per Hallicrafters part/dwg #33A369.	General purpose axe	6Q1001
17	BAG BG–102–A: canvas, olive drab; Daniels CR per Hallicrafters part/dwg #14B109.	Contains parts for support. (Not supplied with A model.)	2Z502
	BLOCK, pulley: w/snap hook; 2 sheaves; 1¾″ dia	Supports antenna	6Q8901.5–2
	BLOCK, pulley: w/becket; 1¾″ single sheave	Supports antenna	6Q8901.5–1
	BLOCK TACKLE: hand operated; pulley and rope; c/o 150 ft rope, 1 rope thimble Masback Hdwe #323, 3 rope clamps, 1 pulley Corbin cabinet #1759–½, 1 pulley Graybar #P–1115, 1 ring, and 1 hook; Amphenol per Sig C dwg #SC–D–14519; Hallicrafters part/dwg #80D101.	To raise antenna support	6Q9271
5, 17	CASE CY–443/TRC–1: steel, olive drab painted; Hallicrafters part/dwg #66C571; per Sig C dwg #SC–C–4681. (Early procurements were packed in Case CY–29(*)/TRC–1.)	Carrying case for mast sections (four used).	2A391–443
	CLEAT: p/o block and tackle assem	Strap to secure rope to block and tackle.	2A480
	CLEAT: p/o block and tackle assem	Strap to secure rope to block and tackle.	2A480–1
	GUY MX–555/U, 50 ft: c/o 3/16″ dia tw nylon rope, 1 thimble Haschco #G412, 1 monkey link, 3 rope clamps, 1 line clamp Stanley Works #7070B, and 1 identification tag; breaking strength 600 lb min; Amphenol per Hallicrafters part/dwg #1C854; per Sig C dwg #SC–D–14518.	Middle antenna mast support guys.	2A264–19B/2
	GUY MX–555/U, 37 ft: c/o 3/16″ dia tw nylon rope, 1 thimble Haschco #G–412, 1 monkey link, 3 rope clamps, 1 line clamp Stanley Works #7070B, and 1 identification tag; breaking strength 600 lb min; Amphenol per Hallicrafters part/dwg #1C855; per Sig C dwg #SC–D–14518.	Bottom antenna mast support guys.	2A264–19B/3
	GUY MX–555/U, 60 ft: c/o 3/16″ dia tw nylon rope, 1 thimble Haschco #G412, 1 monkey link, 3 rope clamps, 1 line clamp Stanley Works #7070B, and 1 identification tag; breaking strength 600 lb min; Amphenol per Hallicrafters part/dwg #1C856; per Sig C dwg #SC–D–14518.	Top antenna mast support guys.	2A1591–141/1
	GUY PLATE MX–552/TRC–1: steel, painted olive drab; Amphenol per Hallicrafters part/dwg #63B394; per Sig C dwg #SC–A–14520–C.	Connect mast and guys	2A264–19A/P1

968874—52—24

11. Identification Table of Parts for Antenna Support AB-33(*)/TRC-1—(Continued)

Figure	Name of part and description	Function of part	Signal Corps stock No.
	GUY STAKE GP-108/U: c/o pipe, plug, and cap; steel galv; Amphenol per Hallicrafters part/dwg #74D281; per Sig C dwg #SC-D-31020.	Ground guy support stakes	2A3300-108
	HAMMER HM-3: sledge, cross peen; 8 lb head, 9″ lg x 2″ face dia; (Hammers HM-1 and HM-2 were supplied with some procurements.) Suppliers, Inc per Hallicrafters part/dwg #33A370.	To drive stakes into ground	6Q49003
	HANDLE: hickory Grade AA; Suppliers, Inc per Hallicrafters part/dwg #33A371.	Handle for Hammer HM-3	6Q51146-36
	MAST BASE AB-102/TRC-1: c/o rectangular steel base plate, rotating swivel mounted in ctr of plate and 2 ferrule type tubes attached to swivel; Amphenol part/dwg #161-104; Hallicrafters part/dwg #67-1057; per Sig C dwg #SC-C-45173.	Mast base Supply p-8 Catalog	2A326-6
	MAST SECTION AB-101/TRC-1: c/o mast sect, retainer, and pin; Amphenol per Hallicrafters part/dwg #57C150; per Sig C dwg #SC-D-14510E.	Parts of antenna support (14 furnished).	2A264-19A/M1
	RACK: Army-Navy Carrying Frame CY-445/TRC-1; steel, olive drab finish; Hallicrafters part/dwg #67D1058; per Sig C dwg #SC-D-19500-C.	Stake and hammer carrying and storage.	2Z4665-445
	RING AND SNAP ASSEMBLY MX-553/TRC-1: c/o 1 steel ring double loop type and 1 snap North & Judd #3387; both parts steel, painted olive drab; Amphenol per Hallicrafters part/dwg #1A857; per Sig C dwg #SC-D-19543.	Connects guys to ground stakes	2A3176-553
	ROPE: sisal; 3/8″ approx dia	Supports antenna	6Z7904A.1
	STAKE GP-2: wrought steel, galv; Vulcan Steel Prod per Hallicrafters part/dwg #74B119; per Sig C dwg #RL-A-120.	Stakes for Mast Base AB-102/TRC-1; driven into ground through holes in mast base.	2A3302

12. Identification Table of Parts for Antenna AS-20(*)/TRC-1

Ref symbol	Models A	B	C	D	E	F	Name of part and description	Function of part	Signal Corps stock No.
	---	---	---	---	---	---	ANTENNA: AS-20A, B, C/TRC-1; dipole; brass, dull gray chromium finish; 37″ lg x 45″ wd max, 24″ wd min; 70 to 99.9 mc; Hallicrafters part #117X043.	Radiates signal	2A202AS-20
	---	---	---	---	---	---	ANTENNA: AS-20D/TRC-1; dipole; 70 to 99.9 mc.	Radiates signal	2A202AS-20D
	---	---	---	---	---	---	ANTENNA: AS-20E/TRC-1; dipole; 70 to 99.9 mc.	Radiates signal	2A202AS-20E
	---	---	---	---	---	---	ANTENNA: AS-20F/TRC-1; dipole; 70 to 99.9 mc.	Radiates signal	2A202AS-20F
	(*)	(*)	(*)	(*)	(*)	(*)	ANTENNA SECTION: dipole; c/o 1 rounded ant tip, 1 end plug, 1 locking ring, 1 collet, 1 element coupling, 1 thd end plug, 1 extension arm and 1 ant arm; brass, dull gray chromium finish; 70 to 100 mc; Hallicrafter part/dwg #57C127; Sig C dwg #SC-D-14512-E.	Dipole elements of antenna (six used).	2A264-19/E1
	---	---	---	---	(*)	(*)	BAG: Sig C Bag BG-102-A; general purpose; canvas, olive drab; .71 cu ft, 15″ lg x 10″ wd x 12½″ h o/a approx; 1 compartment; Daniels CR per U. S. Army spec 71-3308; Hallicrafters part/dwg #14C109.	Holds antenna parts	2Z502

Ref symbol	Models A	B	C	D	E	F	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	(*)	LINE, RF trans: Sig C Cord CG–107A/U uses Radio Frequency Cable RG–8A/U; 65 ft lg excluding terminations; Hallicrafters part/dwg #87B1763; per Sig C dwg #SC–B–22831–A. (Unlettered through E models used Cord CD–800 (50 ft).)	Feed r-f power to antenna and received signal to receiver (two used).	3E6015–107-780
	---	---	---	---	---	(*)	LINE, RF trans: Sig C Cord CG–107A/U (35 feet) uses Radio Frequency Cable RG–8A/U; 35 ft 6″ lg o/a; Hallicrafters part/dwg #87B1764; per Sig C dwg #SC–B–22831–A.	Feeds r-f power to antenna and received signal to receiver.	3E6015–107-420
	---	---	---	(*)	(*)	--	LINE, RF trans: Sig C Cord CG–107A/U; uses Radio Frequency Cable RG–8A/U; 15 ft $9\frac{5}{16}$″ lg o/a.	Feed r-f power to antenna and received signal to receiver.	1F430–107-186
	(*)	(*)	(*)	(*)	(*)	(*)	CASE: Case CY–444/TRC–1; steel, olive drab; $40\frac{1}{2}$″ lg x $15\frac{1}{4}$″ wd x 5″ d o/a; interior has wood supporting member to secure junction boxes and mast sect; interior of cover has wood supporting member to secure ant elements and contains label showing packing list and freq setting chart for elements; 1 folding handle ctr ea end; hinged cover; Hallicrafters part/dwg #66D570; Sig C dwg #SC–B–31146. (Unlettered through D models used Case CY–30(*)/TRC–1.)	Hold antenna parts (two used).	2A391–444
	(*)	(*)	(*)	(*)	(*)	(*)	CLAMP: guy wire; u/w wire or rope from $\frac{1}{8}$″ to $\frac{5}{16}$″ thk.	To fasten wire	2A264–19B/C2
	---	(*)	(*)	(*)	---	---	COLLET: ring	To adjust dipole	2A202AS–20B/R1
	(*)	(*)	(*)	(*)	(*)	(*)	CONNECTOR: adapter; Sig C Plug PL–258; double ended female; 2 round cont, 1 ea end; straight; $1\frac{1}{8}$″ lg x .625″ OD; cylindrical brass body, silver pl; Hallicrafters part/dwg #10A201.	Connects two lengths of coaxial cable.	2Z7226–258
	---	---	---	---	---	(*)	HEAD, mast: c/o 2 main parts, a cylindrical body and half circle cap; $3\frac{3}{8}$″ wd x $4\frac{1}{2}$″ thk x 11″ lg approx o/a; fits on mast sect; Amphenol as per Hallicrafters part/dwg #57D128; per Sig C dwg #SC–D–31008.	Antenna support holder	2A1505–4
	(*)	(*)	(*)	(*)	(*)	---	HEAD, mast: fits on mast sect; $8\frac{11}{16}$″ h x $4\frac{3}{16}$″ wd x $5\frac{1}{2}$″ d o/a.	Antenna support	2A264–19A/M3
	(*)	(*)	(*)	(*)	(*)	---	INSULATOR: standoff; rd post shape; bakelite LTS–E–6; $2\frac{7}{8}$″ lg x $1\frac{1}{4}$″ OD.	Insulator	3G1901
	(*)	(*)	(*)	(*)	(*)	(*)	MAST SECTION ASSEMBLY: ant mast sect extension; c/o 3 main sect, 2″ OD fibreglas tube in ctr; terminated in steel tubes ea end; olive drab; cylindrical shape; assembly $36\frac{5}{8}$″ lg x 2″ OD; Amphenol per Hallicrafters part/dwg #57D129; per Sig C dwg #SC–D–31012.	Hold mast head assembly (two furnished).	2A2496–38
	---	(*)	(*)	(*)	---	---	NUT, collet; brass, dull chrome finish; $\frac{11}{16}$″–20 int thd.		2A202AS–20B/C2
	---	---	---	---	---	(*)	SUPPORT, antenna section: used to support ant dipoles; plastic glassweld boom. Amphenol per Hallicrafters part/dwg #67–1388; per Sig C dwg #SC–D–31004.	Holds antenna dipoles	2A3393A.161
	(*)	(*)	(*)	(*)	(*)	---	SUPPORT: ant. sect; provides support for ant dipoles; brass tubing w/bronze cast tee.	For mounting dipoles	2A264–19/S1

12. Identification Table of Parts for Antenna AS-20(*)/TRC-1—(Continued)

Ref symbol	Models A	B	C	D	E	F	Name of part and description	Function of part	Signal Corps stock No.
	(*)	(*)	(*)	(*)	(*)	(*)	TAG: Sig C Tag MC-72; white hard durable paper; 3¼″ lg x 1⅝″ wd x .015″ thk; supplied w/steel galv fastening wire, 12″ lg before attaching; Central Tag Co per Hallicrafter part/dwg #31B754; per U. S. Army spec 71-436.	For recording frequency adjustment of antenna (12 furnished).	4Z7272
	(*)	(*)	(*)	(*)	(*)	(*)	TAPE, insulating: roll Tape TL-83; cotton; adhesive; ¾″ wd, 1/32″ thk, black; 3/34″ diam x ¾″ wd; breakdown voltage 1000 v min; 82.5 ft, ½ lb roll; Joseph E Bredemann per Hallicrafters part/dwg #33A361; per Federal spec HH-T-101.	General usage tape (four rolls supplied).	6N8583
	(*)	(*)	(*)	(*)	(*)	(*)	TAPE, insulating: Tape TL-192; rubber adhesive; ¾″ wd, .045″ thk, black; 4″ diam x ¾″ wd; 10,000 v AC; 15 ft roll; Joseph E Bredemann Co per Hallicrafters part/dwg #33A362; per U. S. Army spec 71-3082.	Waterproofing tape (four rolls supplied).	6N8692
	(*)	(*)	(*)	(*)	(*)	(*)	WRENCH: double open end hex; 25/32″ and 15/32″ openings; 9⅛″ lg x 11/32″ thk; alloy steel black finish; head offsets 15°; flat straight handle; Plomb Tool #3039; Hallicrafters part/dwg #33A363. (Single open end or box end wrenches are in some procurements.)	Tightens dipoles	6R55525-37

13. Identification Table of Parts for Accessory Kit No. 1

Note. Case CY-67/TRC-1 was part of some procurements.

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	ACCESSORY KIT: 19 13/16″ lg x 21″ wd x 27″ h o/a; Hallicrafters part/dwg #117X037.	Accessory items for operation and maintenance of radio set.	2S5002-3-1
	CABLE ASSEMBLY, power: Sig C Cord CD-711; 50 ft lg approx excluding terminations; female connector 1 end, male connector other end; Hallicrafters part/dwg #87-1690; Sig C dwg #SC-A-8888.	A-c extension cord	3E1711
	CABLE ASSEMBLY, special purpose: Army-Navy Cord CX-104/TRC-1; 10 ft 10″ lg excluding terminations; Hallicrafters part/dwg #87D1692; Sig C dwg #SC-D-14466.	Control cables between transmitters and receivers.	3E6000-104
	CASE: Army-Navy Chest CY-64( )/U; plywood, olive drab finish; 19 13/16″ lg x 21″ wd x 27″ h o/a; 12 trays; 4 folding type handles, 2 ea side; United Guitar Corp per Hallicrafters part/dwg #78D578; Sig C dwg #SC-D-11529.	Accessory parts storage	2Z2499-64
	CORD, headset: Sig C Cord CD-874; 6½ ft; 2 cond; Junction Box JB-47 on 1 end, Plug PL-55 other end.	Connects headset to receiver	3E1874
	CORD, microphone: Sig C Cord CD-318; uses 7 ft Sig C Cordage CO-122-A or CO-145 and 8 in. Sig C Cordage CO-199-B; 8 ft lg o/a; Cordage CO-145 or CO-122-A terminates in Plug PL-68 or PL-68-A at 1 end, other end terminated in Switch SW-141; Sig C dwg #SC-D-14639 and #SC-D-14640.	Connects Microphone T-45 to transmitter.	3E1318
	HANDSET: Army-Navy Handset H-23/U; 250 ohm receiving unit; rubber sleeves over 2 plugs; Hallicrafters part/dwg #85-097; U. S. Army spec #71-3157.	Changes pulsating dc to sound waves; and sound waves to pulsating dc.	2B620-23
	HEADSET: Sig C Headset HS-30/U; receiver impedance 128 ohms nom; Erla part/dwg #14369; U. S. Army spec #71-1518.	Changes a-f impulses to sound waves.	2B830

13. Identification Table of Parts for Accessory Kit No. 1—(Continued)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	INSERT, headset: Sig C Insert M–300; neoprene mushroom shaped; Hallicrafters part/dwg #17A050; Sig C dwg #SC–A–7978.	Ear protectors	2B1300
	LABEL: 6″ lg x 5″ wd x .030″ thk; black print on white background; four .194″ diam mtg holes on 5½″ x 4½″ mtg/c; white opaque plastic bonded to clear plastic, matte finish; Felsenthal Co per Hallicrafters part/dwg #8C1199; Military spec MIL–R–10174.	Contents label	2Z5872.7
	LAMP, incandescent: 120 v 50 w; bulb inside frosted; 3⅝″ lg; medium screw base; tungsten fil; GE Mazda #A–19; Hallicrafters part/dwg #39A001.	Lamp for trouble light	6Z6820–1
	LIGHT, extension: rubber covered; 25 ft; parallel blade nonpolarized male plug 1 end, lampholder w/cage type lamp protector other end; 50 w size, reflector wire guard w/hook; female 2 cont socket on side of holder; Englewood Elect Sup per Hallicrafters part/dwg #33C095.	Trouble lamp with cord and plug.	6Z6897–2
	MICROPHONE, carbon: Sig C Microphone T–45; resistance new 40–100 ohms, aged 50–125 ohms; freq response substantially flat between 200–4000 cyc; Hallicrafters part/dwg #114A786; U. S. Army spec #71–1603.	Changes sound waves to pulsating dc.	2B1645
	PULLER, tube: Sig C Tube Puller TL–201; steel cad pl; c/o pair of tongs w/special shaped neoprene covered lip curved to fit contours of radio tubes; approx 8″ lg x ½″ thk o/a; Hallicrafters part/dwg #33A360; Sig C dwg #SC–D–7459.	Glass tube puller	6R7442
	PULLER, tube: steel cad pl; tong type; 7⅛″ x 1³⁄₃₂″ diam o/a; Hallicrafters part/dwg #33B356.	Removing tubes	6R7443–2
	SCREWDRIVER: Sig C Screwdriver TL–360/U; slot drive; 6″ blade; 9″ o/a lg; sq steel shank ³⁄₁₆″ tip; X celite handle; Park-Metalware #S3166; Hallicrafters part/dwg #33–385.	Loosens and tightens slotted head screws.	6R16091
	SCREWDRIVER: slot drive; 2″ blade; 3⅞″ o/a lg; ¼″ diam round shank; ⅛″ tip; round amberyl handle; w/clip; Stanley Tools #1010; Hallicrafters part/dwg #33–386.	Loosens and tightens screws	6R15292
	TERMINAL BOX: Sig C Junction Box JB–110; contains 5 duplex female cont receptacles; steel, olive drab finish; w/cover; 12½″ lg x 4¹¹⁄₁₆″ wd x 1⅞″ h; Hallicrafters part/dwg #117X025; Sig C dwg #SC–D–11461.	Provides ten a-c outlets	6Z1041
	TOOL, alinement: Sig C Alignment Tool TL–150; phenolic body; 6¹⁄₁₆″ lg x ¼″ diam o/a; steel scdr ³⁵⁄₆₄″ lg x ³⁄₁₆″ wd 1 end; phenolic knob 1⅜″ diam x ⅞″ d other end; Hallicrafters part/dwg #33B357.	To aline transmitter or receiver.	6Q338–150

14. Identification Table of Parts for Accessory Kit No. 2

Note. The following items have been a part of Accessory Kit No. 2 with early procurements of Radio Terminal Set AN/TRC–3G and Radio Relay Set AN/TRC–4G:

Case CY–67/TRC–1
Cord CG–107/U (40 in.)
Pliers TL–125
Pliers TL–126
Flashlight TL–122–D
Indicator Subassembly MX–970/U
Knife TL–29
Soldering Iron TL–117
Technical Manual TM 11–333
Telephone EE–8–B

14. Identification Table of Parts for Accessory Kit No. 2—(Continued)

Figure	Name of part and description	Function of part	Signal Corps stock No.
23	ACCESSORY KIT: 19$\frac{13}{16}$″ lg x 21″ wd x 27″ h o/a; Hallicrafters part/dwg #117X038.	Accessory items for operation and maintenance of radio set.	2S5002–3–2
23	CABLE ASSEMBLY, power: Sig C Cord CD–711; 50 ft lg approx excluding terminations; female connector 1 end, male connector other end; Hallicrafters part/dwg #87–1690; Sig C dwg #SC–A–8888.	A-c extension cords	3E1711
23	CABLE ASSEMBLY, special purpose: Army-Navy Cord CX–104/TRC–1; 10 ft 10″ lg excluding terminations; Hallicrafters part/dwg #87D1692; Sig C dwg #SC–D–14466.	Control cables between transmitters and receivers.	3E6000–104
23	CASE: Army-Navy Chest CY–64( )/U; plywood, olive drab finish; 19$\frac{13}{16}$″ lg x 21″ wd x 27″ h o/a; 12 trays; 4 folding type handles, 2 ea side; United Guitar Corp per Hallicrafters part/dwg #78D578; Sig C dwg #SC–D–11529. (Early models used Chest BC–5.)	Accessory parts storage	2Z2499–64
18	CONTROL, radio set: Army-Navy Control Box C–21D/TRC–1; rectangular metal case, olive drab finish; removable bottom cover; 4$\frac{7}{8}$″ lg x 3$\frac{1}{4}$″ d x 2$\frac{1}{8}$″ h; Hallicrafters part/dwg #117X047; Sig C dwg #SC–D–16707.	Transfers input and output circuit to single microphone and headset.	2C666–21D
23	PULLER, tube: Sig C Tube Puller TL–201; steel cad pl; c/o pair of tongs w/special shaped neoprene covered lip curved to fit contours of radio tubes; approx 8″ lg x $\frac{1}{2}$″ thk o/a; Hallicrafters part/dwg #33A360; Sig C dwg #SC–D–7459.	Glass tube puller	6R7442
23	PULLER, tube: steel cad pl; tong type; 1$\frac{3}{32}$″ diam o/a; Link #7489.	Metal tube puller	6R7443–2
	TERMINAL BOX: Army-Navy Junction Box J–85/G; incl 2 power cables w/male plugs, 2 female connectors, one 3 pole DT toggle switch; steel, painted olive drab; w/cover; 4$\frac{3}{8}$″ lg x 5$\frac{1}{2}$″ wd x 4$\frac{1}{8}$″ h; Hallicrafters part/dwg #117X021; Sig C dwg #SC–D–15907.	Connect either of two power units to radio equipments.	2Z5600–85
19	TERMINAL BOX: Sig C Junction Box JB–110; contains 5 duplex female cont receptacles; steel, olive drab finish; w/cover; 12$\frac{1}{2}$″ lg x 4$\frac{11}{16}$″ wd x 1$\frac{7}{8}$″ h; Hallicrafters part/dwg #117X025; Sig C dwg #SC–D–11461.	Provides means for connecting a maximum of ten two-conductor power cords to one power outlet.	6Z1041
23	TOOL, alinement: Sig C Alignment Tool TL–150; phenolic body; 6$\frac{1}{16}$″ lg x $\frac{1}{4}$″ diam o/a; steel scdr $\frac{35}{64}$″ lg x $\frac{3}{16}$″ wd at 1 end; phenolic knob 1$\frac{3}{8}$″ diam x $\frac{7}{8}$″ d other end; Hallicrafters part/dwg #33B357. (Alignment Tool TL–201 or TL–601/U may be substituted.)	To aline transmitter or receiver.	6Q338–150
23	WHISTLE: closed pipe type; 5$\frac{3}{32}$″ lg x 1$\frac{1}{16}$″ wd x $\frac{25}{32}$″ thk; brass, nickel finish; freq 1000 cps interrupted by vibrating reed at 19 cps; WECo type #1A.	Audio signal	6R38049/W

15. Identification Table of Parts for Accessory Kit No. 3

Note. Some procurements Accessory Kit No. 3 had the following additional items:

Case CY–67/TRC–1
Cord CD–318–(*)
Cord CD–874
Microphone T–45–(*)
Pliers TL–103
Pliers TL–125
Cord CG–107/U
Handset H–23(*)/U
Headset HS–30–U
Knife TL–29
Pliers TL–126
Test Oscillator TS–32(*)/TRC–1

15. Identification Table of Parts for Accessory Kit No. 3—(Continued)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	ACCESSORY KIT: c/o one ea Junction Box J–85/G, Cord CD–711, Puller 7⅛", Tube Puller TL–201, WECo Type 1A Whistle 1000–19 cyc, Alignment Tool TL–207, Flashlight TL–122–D, Control Box C–21(*)/TRC–1; two ea Cords CX–104/TRC–1; 12 ea Inserts M–300; packed in Chest CY–64( )/U, 19 13/16" lg x 21" wd x 27" h o/a.	For operation and maintenance on early models of Radio Relay Set AN/TRC–4G only.	2S5002–4–1

16. Identification Table of Parts for Control Box C–21(*)/TRC–1

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CONTROL BOX C–21(*)/TRC–1: provided w/2 telephone plugs PJ–055B and 2 telephone plugs PJ–068 on Cords CD–1251 and CD–1252, jacks JJ–033 and JJ–034 for Handset H–23(*)/U and a 4 PDT toggle sw on exterior of case; metal case, olive drab finish; (2 DPDT switches on models A, B, and C.) 4⅞" lg x 3¼" d x 2⅛" h; Hallicrafters part #117X047; per Sig C dwg #SC–D–16707.	Transfers input and output circuit to single microphone and headset; used at each duplex relay station to allow operator to communicate in either direction.	2C666–21
PC502, PC504	CABLE, SPECIAL PURPOSE ELECTRICAL: Cordage CO–145; 3 #18AWG stranded copper cond.	For use in microphone circuit	3E2145
PC501, PC503	CABLE, power: Cordage CO–144; flex cordage; two #18AWG stranded copper cord.	For use in audio cords	3E2144
W501, W503	CORD, headset: Sig C Cord CD–1251; Sig C Cordage CO–144; 3 ft lg, excluding terminations; tp plug PJ–055B at one end, two 4½" lg leads at other end stripped ½" and tinned; Hallicrafters part/dwg #87C1769; per Sig C dwg #SC–D–13517.	W501: Headset cord, A circuit transmitter. W503: Headset cord, B circuit transmitter.	3E1999–251–36
W502, W504	CORD, microphone: Sig C Cord CD–1252; Sig C Cordage CO–145; 3 ft lg excluding terminations; tp plug PJ–068 at one end, three 4½" leads at other end ea stripped ½" and tinned; Hallicrafters part/dwg #87C1768; per Sig C dwg #SC–D–13518.	W502: Microphone cord to A circuit transmitter. W504: Microphone cord to B circuit transmitter.	3E1999–252–36
	COVER, jack: c/o flap and flange steel olive drab; toilet seat cover shape.	Covers jacks. (D model only.)	2ZK5650A
J501	JACK: for 2 cond plug .25" dia; Mallory type #SC–1A; Hallicrafters part/dwg #36B050.	Headset output	2Z5534
J502	JACK: for Sig C Plugs PL–46 and PL–68; contains nonturn device; Mallory #SCA–28; Hallicrafters part/dwg #36B049.	Microphone input	2Z5533
P501, P503	PLUG: 2 cond; single shank; Heath Co per Hallicrafters part/dwg #10A382.	P501: Audio output of A circuit receiver (taken from B circuit transmitter). P503: Audio output of B circuit receiver (taken from A circuit transmitter).	2Z7228A–55B
P502, P504	PLUG: 3 cond; single shank; Heath Co per Hallicrafters part/dwg #10A383.	P502: Microphone line to B circuit transmitter. P504: Microphone line to A circuit transmitter.	2Z7168
S501	SWITCH, toggle: 4PDT; 10 amp 250 v; 12 solder lug term on bottom; C-H part #766–5K3; Hallicrafters part/dwg #60A 398; per Sig C dwg #SC–D–16707–4.	Circuit direction switch. (Used in B model, Order No. 532–MPD–45; C model, Order No. 24689–PH–49; and D model.)	3Z9845–11.5.218
S501, S502	SWITCH, toggle: DPDT; normally closed	Circuit direction switches. (Used in A model; B model Order Nos. 533–MPD–4 and 1003–MPD–45; and C model, Order No. 1621–PH–49.)	3Z9858–8.64

17. Identification Table of Parts for Junction Box J–85/G

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	JUNCTION BOX J–85/G: includes 2 power cables w/male plugs Hubbell type #7238, 2 female connectors Hubbell type #7210, and one TPDT toggle switch Cutler-Hammer #8792–K4; steel, painted olive drab; w/cover; 4⅜″ lg x 5½″ wd x 4⅛″ h; Hallicrafters part #117X021; per Sig C dwg #SC–D–15907.	Connects either of two Power Units PE–75–(*) to radio equipment.	2Z5600–85
W601, W602	CABLE ASSEMBLY, power: 2 cond, #12 AWG stranded; 11 ft lg excluding terminations; Hubbell connector #7238 on 1 end, 2 term lugs other end; Hallicrafters part/dwg #87C1695; per Sig C dwg #SC–D–15910.	Cords to power unit	3E7160–37
J601, J602	CONNECTOR, receptacle: 2 curved female cont; straight type; 20 amp at 250 v; Hubbell #7210.	Radio equipment sockets	6Z7808
P601, P602	CONNECTOR, plug: 2 curved male cont blades; straight type; 20 amp at 250 v; Hubbell type #7238.	Power unit cord plugs	6Z1734.1
	GASKET: Buna S 50–60; single hole; round, 2″ OD x 1¹⁵⁄₁₆″ ID x ⁵⁄₃₂″ thk; Atlan India Rub per Sig C dwg #SC–D–15909–8; Hallicrafters part/dwg #12A051.	Plug entry seals	2Z4867.682
	GASKET: Buna S 50–60; single hole; round 1″ OD x .843″ ID x ¹⁄₁₆″ thk; Atlan India Rub per Sig C dwg #SC–D–15909–10; Hallicrafters part/dwg #12A052.	Cable entry seals	2Z4868.746
	GASKET: Buna S 50–60; twelve .1695″ dia holes, rectangular cutout 4⅜″ wd x 3⅞″ lg; rectangular, 5⅜″ wd x 4⅞″ lg x ¹⁄₁₆″ thk; Atlan India Rub per Sig C dwg #SC–D–15909–7; Hallicrafters part/dwg #12C050.	Entry plate	2Z4868.744
	GASKET: vellutex; single hole; round ⁵⁄₁₆″ OD x .173″ ID x ¹⁄₁₆″ thk; Vellumoid per Sig C dwg #SC–D–15909–11; Hallicrafters part/dwg #12A053.	Screw gasket (eight in use)	2Z4868.745
	GASKET: Buna S 50–60; single hole; round pyramid, 1⅛″ dia at base, ⁵⁄₁₆″ dia at peak, ⁹⁄₁₆″ thk; Atlan India Rub per Sig C dwg #SC–D–15909–9; Hallicrafters part/dwg #12B054.	Switch cover	2Z4868.743
S601	SWITCH, toggle: TPDT; 35 amp at 240 v AC	Transfer switch	3Z9849.162

18. Identification Table of Parts for Junction Box JB–110

Figure	Name of part and description	Function of part	Signal Corps stock No.
19	JUNCTION BOX JB–110: steel, olive drab; w/cover; power cords to 1 outlet; for ½″ conduit or 12½″ lg x 4¹¹⁄₁₆″ wd x 1⅞″ h excluding cord; contains 5 std duplex receptacles, one #10 AWG 2 cond type cord w/std male connector on 1 end, other end terminated in term box; Sig C dwg #SC–D–11461.	Provides means for connecting a maximum of 10 two-conductor power cords to 1 power outlet.	6Z1041
	CABLE, power: 2 #10 AWG, cond stranded; 300 v AC; Hallicrafters part/dwg #87A1699.		1B810.11–1
	CONNECTOR, female contact: 2 flat parallel blades; straight type; 2.625″ lg x 1.328″ wd x 1¼″ h o/a less mtg bkt; 10 amp 250 v, 15 amp 115 v; rectangular bakelite body; mtg by 1 elongated hole in ea of 2 bkt on 3.281″ mtg/c; Hubbell #9575; Hallicrafters part/dwg #10A199.	Socket for power output connections.	6Z7786–1
	CONNECTOR, male contact: 2 flat parallel blades; straight type; 1.531″ diam x .625″ h less cable clamp and cont; 10 amp 250 v, 15 amp 125 v; metal body w/bakelite insert; cable opening .406″ to .625″ incl cables clamp; Hubbell #7184; Hallicrafters part/dwg #10A101.	Power input connector on end of power cable.	6Z1734.5

19. Identification Table of Parts for Crystal Unit Set 2X13.1–12

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CRYSTAL UNIT SET, quartz: for freq determination of xmtr and rec; c/o transmitter Crystal Units CR–4/U and receiver Crystal Unit CR–6/U; stored in Case CY–44/TRC–3, 19 1/8″ lg x 17 1/8″ wd x 10 3/16″ h o/a; Hallicrafters part #117X044 and Hallicrafters part #117X045.	Frequency controlling crystals	2X13.1–12
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–4/U; c/o 2 ea of the following 300 xtal units, freq as follows:	For frequency control of transmitter.	2X13.1–3
	729.167 kc, channel 70.0		2X13–700
	730.208 kc, channel 70.1		2X13–701
	731.250 kc, channel 70.2		2X13–702
	732.292 kc, channel 70.3		2X13–703
	733.333 kc, channel 70.4		2X13–704
	734.375 kc, channel 70.5		2X13–705
	735.417 kc, channel 70.6		2X13–706
	736.458 kc, channel 70.7		2X13–707
	737.500 kc, channel 70.8		2X13–708
	738.542 kc, channel 70.9		2X13–709
	739.583 kc, channel 71.0		2X13–710
	740.625 kc, channel 71.1		2X13–711
	741.667 kc, channel 71.2		2X13–712
	742.708 kc, channel 71.3		2X13–713
	743.750 kc, channel 71.4		2X13–714
	744.792 kc, channel 71.5		2X13–715
	745.833 kc, channel 71.6		2X13–716
	746.875 kc, channel 71.7		2X13–717
	747.917 kc, channel 71.8		2X13–718
	748.958 kc, channel 71.9		2X13–719
	750.000 kc, channel 72.0		2X13–720
	751.042 kc, channel 72.1		2X13–721
	752.083 kc, channel 72.2		2X13–722
	753.125 kc, channel 72.3		2X13–723
	754.167 kc, channel 72.4		2X13–724
	755.208 kc, channel 72.5		2X13–725
	756.250 kc, channel 72.6		2X13–726
	757.292 kc, channel 72.7		2X13–727
	758.333 kc, channel 72.8		2X13–728
	759.375 kc, channel 72.9		2X13–729
	760.417 kc, channel 73.0		2X13–730
	761.458 kc, channel 73.1		2X13–731
	762.500 kc, channel 73.2		2X13–732
	763.542 kc, channel 73.3		2X13–733
	764.583 kc, channel 73.4		2X13–734
	765.625 kc, channel 73.5		2X13–735
	766.667 kc, channel 73.6		2X13–736
	767.708 kc, channel 73.7		2X13–737
	768.750 kc, channel 73.8		2X13–738
	769.792 kc, channel 73.9		2X13–739
	770.833 kc, channel 74.0		2X13–740
	771.875 kc, channel 74.1		2X13–741
	772.917 kc, channel 74.2		2X13–742
	773.958 kc, channel 74.3		2X13–743
	775.000 kc, channel 74.4		2X13–744
	776.042 kc, channel 74.5		2X13–745
	777.083 kc, channel 74.6		2X13–746
	778.125 kc, channel 74.7		2X13–747
	779.167 kc, channel 74.8		2X13–748
	780.208 kc, channel 74.9		2X13–749
	781.250 kc, channel 75.0		2X13–750

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	782.292 kc, channel 75.1		2X13–751
	783.333 kc, channel 75.2		2X13–752
	784.375 kc, channel 75.3		2X13–753
	785.417 kc, channel 75.4		2X13–754
	786.458 kc, channel 75.5		2X13–755
	787.500 kc, channel 75.6		2X13–756
	788.542 kc, channel 75.7		2X13–757
	789.583 kc, channel 75.8		2X13–758
	790.625 kc, channel 75.9		2X13–759
	791.667 kc, channel 76.0		2X13–760
	792.708 kc, channel 76.1		2X13–761
	793.750 kc, channel 76.2		2X13–762
	794.792 kc, channel 76.3		2X13–763
	795.833 kc, channel 76.4		2X13–764
	796.875 kc, channel 76.5		2X13–765
	797.917 kc, channel 76.6		2X13–766
	798.958 kc, channel 76.7		2X13–767
	800.000 kc, channel 76.8		2X13–768
	801.042 kc, channel 76.9		2X13–769
	802.083 kc, channel 77.0		2X13–770
	803.125 kc, channel 77.1		2X13–771
	804.167 kc, channel 77.2		2X13–772
	805.208 kc, channel 77.3		2X13–773
	806.250 kc, channel 77.4		2X13–774
	807.292 kc, channel 77.5		2X13–775
	808.333 kc, channel 77.6		2X13–776
	809.375 kc, channel 77.7		2X13–777
	810.417 kc, channel 77.8		2X13–778
	811.458 kc, channel 77.9		2X13–779
	812.500 kc, channel 78.0		2X13–780
	813.542 kc, channel 78.1		2X13–781
	814.583 kc, channel 78.2		2X13–782
	815.625 kc, channel 78.3		2X13–783
	816.667 kc, channel 78.4		2X13–784
	817.708 kc, channel 78.5		2X13–785
	818.750 kc, channel 78.6		2X13–786
	819.792 kc, channel 78.7		2X13–787
	820.833 kc, channel 78.8		2X13–788
	821.875 kc, channel 78.9		2X13–789
	822.917 kc, channel 79.0		2X13–790
	823.958 kc, channel 79.1		2X13–791
	825.000 kc, channel 79.2		2X13–792
	826.042 kc, channel 79.3		2X13–793
	827.083 kc, channel 79.4		2X13–794
	828.125 kc, channel 79.5		2X13–795
	829.167 kc, channel 79.6		2X13–796
	830.208 kc, channel 79.7		2X13–797
	831.250 kc, channel 79.8		2X13–798
	832.292 kc, channel 79.9		2X13–799
	833.333 kc, channel 80.0		2X13–800
	834.375 kc, channel 80.1		2X13–801
	835.417 kc, channel 80.2		2X13–802
	836.458 kc, channel 80.3		2X13–803
	837.500 kc, channel 80.4		2X13–804
	838.542 kc, channel 80.5		2X13–805
	839.583 kc, channel 80.6		2X13–806
	840.625 kc, channel 80.7		2X13–807
	841.667 kc, channel 80.8		2X13–808
	842.708 kc, channel 80.9		2X13–809

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	843.750 kc, channel 81.0		2X13–810
	844.792 kc, channel 81.1		2X13–811
	845.833 kc, channel 81.2		2X13–812
	846.875 kc, channel 81.3		2X13–813
	847.917 kc, channel 81.4		2X13–814
	848.958 kc, channel 81.5		2X13–815
	850.000 kc, channel 81.6		2X13–816
	851.042 kc, channel 81.7		2X13–817
	852.083 kc, channel 81.8		2X13–818
	853.125 kc, channel 81.9		2X13–819
	854.167 kc, channel 82.0		2X13–820
	855.208 kc, channel 82.1		2X13–821
	856.250 kc, channel 82.2		2X13–822
	857.292 kc, channel 82.3		2X13–823
	858.333 kc, channel 82.4		2X13–824
	859.375 kc, channel 82.5		2X13–825
	860.417 kc, channel 82.6		2X13–826
	861.458 kc, channel 82.7		2X13–827
	862.500 kc, channel 82.8		2X13–828
	863.542 kc, channel 82.9		2X13–829
	864.583 kc, channel 83.0		2X13–830
	865.625 kc, channel 83.1		2X13–831
	866.667 kc, channel 83.2		2X13–832
	867.708 kc, channel 83.3		2X13–833
	868.750 kc, channel 83.4		2X13–834
	869.792 kc, channel 83.5		2X13–835
	870.833 kc, channel 83.6		2X13–836
	871.875 kc, channel 83.7		2X13–837
	872.917 kc, channel 83.8		2X13–838
	873.958 kc, channel 83.9		2X13–839
	875.000 kc, channel 84.0		2X13–840
	876.042 kc, channel 84.1		2X13–841
	877.083 kc, channel 84.2		2X13–842
	878.125 kc, channel 84.3		2X13–843
	879.167 kc, channel 84.4		2X13–844
	880.208 kc, channel 84.5		2X13–845
	881.250 kc, channel 84.6		2X13–846
	882.292 kc, channel 84.7		2X13–847
	883.333 kc, channel 84.8		2X13–848
	884.375 kc, channel 84.9		2X13–849
	885.417 kc, channel 85.0		2X13–850
	886.458 kc, channel 85.1		2X13–851
	887.500 kc, channel 85.2		2X13–852
	888.542 kc, channel 85.3		2X13–853
	889.583 kc, channel 85.4		2X13–854
	890.625 kc, channel 85.5		2X13–855
	891.667 kc, channel 85.6		2X13–856
	892.708 kc, channel 85.7		2X13–857
	893.750 kc, channel 85.8		2X13–858
	894.792 kc, channel 85.9		2X13–859
	895.833 kc, channel 86.0		2X13–860
	896.875 kc, channel 86.1		2X13–861
	897.917 kc, channel 86.2		2X13–862
	898.958 kc, channel 86.3		2X13–863
	900.000 kc, channel 86.4		2X13–864
	901.042 kc, channel 86.5		2X13–865
	902.083 kc, channel 86.6		2X13–866
	903.125 kc, channel 86.7		2X13–867
	904.167 kc, channel 86.8		2X13–868

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	905.208 kc, channel 86.9		2X13–869
	906.250 kc, channel 87.0		2X13–870
	907.292 kc, channel 87.1		2X13–871
	908.333 kc, channel 87.2		2X13–872
	909.375 kc, channel 87.3		2X13–873
	910.417 kc, channel 87.4		2X13–874
	911.458 kc, channel 87.5		2X13–875
	912.500 kc, channel 87.6		2X13–876
	913.542 kc, channel 87.7		2X13–877
	914.583 kc, channel 87.8		2X13–878
	915.625 kc, channel 87.9		2X13–879
	916.667 kc, channel 88.0		2X13–880
	917.708 kc, channel 88.1		2X13–881
	918.750 kc, channel 88.2		2X13–882
	919.792 kc, channel 88.3		2X13–883
	920.833 kc, channel 88.4		2X13–884
	921.875 kc, channel 88.5		2X13–885
	922.917 kc, channel 88.6		2X13–886
	923.958 kc, channel 88.7		2X13–887
	925.000 kc, channel 88.8		2X13–888
	926.042 kc, channel 88.9		2X13–889
	927.083 kc, channel 89.0		2X13–890
	928.125 kc, channel 89.1		2X13–891
	929.167 kc, channel 89.2		2X13–892
	930.208 kc, channel 89.3		2X13–893
	931.250 kc, channel 89.4		2X13–894
	932.292 kc, channel 89.5		2X13–895
	933.333 kc, channel 89.6		2X13–896
	934.375 kc, channel 89.7		2X13–897
	935.417 kc, channel 89.8		2X13–898
	936.458 kc, channel 89.9		2X13–899
	937.500 kc, channel 90.0		2X13–900
	938.542 kc, channel 90.1		2X13–901
	939.583 kc, channel 90.2		2X13–902
	940.625 kc, channel 90.3		2X13–903
	941.667 kc, channel 90.4		2X13–904
	942.708 kc, channel 90.5		2X13–905
	943.750 kc, channel 90.6		2X13–906
	944.792 kc, channel 90.7		2X13–907
	945.833 kc, channel 90.8		2X13–908
	946.875 kc, channel 90.9		2X13–909
	947.917 kc, channel 91.0		2X13–910
	948.958 kc, channel 91.1		2X13–911
	950.000 kc, channel 91.2		2X13–912
	951.042 kc, channel 91.3		2X13–913
	952.083 kc, channel 91.4		2X13–914
	953.125 kc, channel 91.5		2X13–915
	954.167 kc, channel 91.6		2X13–916
	955.208 kc, channel 91.7		2X13–917
	956.250 kc, channel 91.8		2X13–918
	957.292 kc, channel 91.9		2X13–919
	958.333 kc, channel 92.0		2X13–920
	959.375 kc, channel 92.1		2X13–921
	960.417 kc, channel 92.2		2X13–922
	961.458 kc, channel 92.3		2X13–923
	962.500 kc, channel 92.4		2X13–924
	963.542 kc, channel 92.5		2X13–925
	964.583 kc, channel 92.6		2X13–926
	965.625 kc, channel 92.7		2X13–927

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	966.667 kc, channel 92.8		2X13–928
	967.708 kc, channel 92.9		2X13–929
	968.750 kc, channel 93.0		2X13–930
	969.792 kc, channel 93.1		2X13–931
	970.833 kc, channel 93.2		2X13–932
	971.875 kc, channel 93.3		2X13–933
	972.917 kc, channel 93.4		2X13–934
	973.958 kc, channel 93.5		2X13–935
	975.000 kc, channel 93.6		2X13–936
	976.042 kc, channel 93.7		2X13–937
	977.083 kc, channel 93.8		2X13–938
	978.125 kc, channel 93.9		2X13–939
	979.167 kc, channel 94.0		2X13–940
	980.208 kc, channel 94.1		2X13–941
	981.250 kc, channel 94.2		2X13–942
	982.292 kc, channel 94.3		2X13–943
	983.333 kc, channel 94.4		2X13–944
	984.375 kc, channel 94.5		2X13–945
	985.417 kc, channel 94.6		2X13–946
	986.458 kc, channel 94.7		2X13–947
	987.500 kc, channel 94.8		2X13–948
	988.542 kc, channel 94.9		2X13–949
	989.583 kc, channel 95.0		2X13–950
	990.625 kc, channel 95.1		2X13–951
	991.667 kc, channel 95.2		2X13–952
	992.708 kc, channel 95.3		2X13–953
	993.750 kc, channel 95.4		2X13–954
	994.792 kc, channel 95.5		2X13–955
	995.833 kc, channel 95.6		2X13–956
	996.875 kc, channel 95.7		2X13–957
	997.917 kc, channel 95.8		2X13–958
	998.958 kc, channel 95.9		2X13–959
	1000.000 kc, channel 96.0		2X13–960
	1001.042 kc, channel 96.1		2X13–961
	1002.083 kc, channel 96.2		2X13–962
	1003.125 kc, channel 96.3		2X13–963
	1004.167 kc, channel 96.4		2X13–964
	1005.208 kc, channel 96.5		2X13–965
	1006.250 kc, channel 96.6		2X13–966
	1007.292 kc, channel 96.7		2X13–967
	1008.333 kc, channel 96.8		2X13–968
	1009.375 kc, channel 96.9		2X13–969
	1010.417 kc, channel 97.0		2X13–970
	1011.458 kc, channel 97.1		2X13–971
	1012.500 kc, channel 97.2		2X13–972
	1013.542 kc, channel 97.3		2X13–973
	1014.583 kc, channel 97.4		2X13–974
	1015.625 kc, channel 97.5		2X13–975
	1016.667 kc, channel 97.6		2X13–976
	1017.708 kc, channel 97.7		2X13–977
	1018.750 kc, channel 97.8		2X13–978
	1019.792 kc, channel 97.9		2X13–979
	1020.833 kc, channel 98.0		2X13–980
	1021.875 kc, channel 98.1		2X13–981
	1022.917 kc, channel 98.2		2X13–982
	1023.958 kc, channel 98.3		2X13–983
	1025.000 kc, channel 98.4		2X13–984
	1026.042 kc, channel 98.5		2X13–985
	1027.083 kc, channel 98.6		2X13–986

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	1028.125 kc, channel 98.7		2X13–987
	1029.167 kc, channel 98.8		2X13–988
	1030.208 kc, channel 98.9		2X13–989
	1031.250 kc, channel 99.0		2X13–990
	1032.292 kc, channel 99.1		2X13–991
	1033.333 kc, channel 99.2		2X13–992
	1034.375 kc, channel 99.3		2X13–993
	1035.417 kc, channel 99.4		2X13–994
	1036.458 kc, channel 99.5		2X13–995
	1037.500 kc, channel 99.6		2X13–996
	1038.542 kc, channel 99.7		2X13–997
	1039.583 kc, channel 99.8		2X13–998
	1040.625 kc, channel 99.9		2X13–999
	Hallicrafters part #117X044.		
	CRYSTAL UNIT SET, quartz; Army-Navy Crystal Units CR–6/U; c/o 1 ea of the following 300 xtal units, freq as follows:	For frequency control of receiver.	2X7.1–8
	7500.0 kc, channel 70.0		2X7–7500
	7510.0 kc, channel 70.1		2X7–7510
	7520.0 kc, channel 70.2		2X7–7520
	7530.0 kc, channel 70.3		2X7–7530
	7540.0 kc, channel 70.4		2X7–7540
	7550.0 kc, channel 70.5		2X7–7550
	7560.0 kc, channel 70.6		2X7–7560
	7570.0 kc, channel 70.7		2X7–7570
	7580.0 kc, channel 70.8		2X7–7580
	7590.0 kc, channel 70.9		2X7–7590
	7600.0 kc, channel 71.0		2X7–7600
	7610.0 kc, channel 71.1		2X7–7610
	7620.0 kc, channel 71.2		2X7–7620
	7630.0 kc, channel 71.3		2X7–7630
	7640.0 kc, channel 71.4		2X7–7640
	7650.0 kc, channel 71.5		2X7–7650
	7660.0 kc, channel 71.6		2X7–7660
	7670.0 kc, channel 71.7		2X7–7670
	7680.0 kc, channel 71.8		2X7–7680
	7690.0 kc, channel 71.9		2X7–7690
	7700.0 kc, channel 72.0		2X7–7700
	7710.0 kc, channel 72.1		2X7–7710
	7720.0 kc, channel 72.2		2X7–7720
	7730.0 kc, channel 72.3		2X7–7730
	7740.0 kc, channel 72.4		2X7–7740
	7750.0 kc, channel 72.5		2X7–7750
	7760.0 kc, channel 72.6		2X7–7760
	7770.0 kc, channel 72.7		2X7–7770
	7780.0 kc, channel 72.8		2X7–7780
	7790.0 kc, channel 72.9		2X7–7790
	7800.0 kc, channel 73.0		2X7–7800
	7810.0 kc, channel 73.1		2X7–7810
	7820.0 kc, channel 73.2		2X7–7820
	7830.0 kc, channel 73.3		2X7–7830
	7840.0 kc, channel 73.4		2X7–7840
	7850.0 kc, channel 73.5		2X7–7850
	7860.0 kc, channel 73.6		2X7–7860
	7870.0 kc, channel 73.7		2X7–7870
	7880.0 kc, channel 73.8		2X7–7880

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	7890.0 kc, channel 73.9		2X7–7890
	7900.0 kc, channel 74.0		2X7–7900
	7910.0 kc, channel 74.1		2X7–7910
	7920.0 kc, channel 74.2		2X7–7920
	7930.0 kc, channel 74.3		2X7–7930
	7940.0 kc, channel 74.4		2X7–7940
	7950.0 kc, channel 74.5		2X7–7950
	7960.0 kc, channel 74.6		2X7–7960
	7970.0 kc, channel 74.7		2X7–7970
	7980.0 kc, channel 74.8		2X7–7980
	7990.0 kc, channel 74.9		2X7–7990
	8000.0 kc, channel 75.0		2X7–8000
	8010.0 kc, channel 75.1		2X7–8010
	8020.0 kc, channel 75.2		2X7–8020
	8030.0 kc, channel 75.3		2X7–8030
	8040.0 kc, channel 75.4		2X7–8040
	8050.0 kc, channel 75.5		2X7–8050
	8060.0 kc, channel 75.6		2X7–8060
	8070.0 kc, channel 75.7		2X7–8070
	8080.0 kc, channel 75.8		2X7–8080
	8090.0 kc, channel 75.9		2X7–8090
	8100.0 kc, channel 76.0		2X7–8100
	8110.0 kc, channel 76.1		2X7–8110
	8120.0 kc, channel 76.2		2X7–8120
	8130.0 kc, channel 76.3		2X7–8130
	8140.0 kc, channel 76.4		2X7–8140
	8150.0 kc, channel 76.5		2X7–8150
	8160.0 kc, channel 76.6		2X7–8160
	8170.0 kc, channel 76.7		2X7–8170
	8180.0 kc, channel 76.8		2X7–8180
	8190.0 kc, channel 76.9		2X7–8190
	8200.0 kc, channel 77.0		2X7–8200
	8210.0 kc, channel 77.1		2X7–8210
	8220.0 kc, channel 77.2		2X7–8220
	8230.0 kc, channel 77.3		2X7–8230
	8240.0 kc, channel 77.4		2X7–8240
	8250.0 kc, channel 77.5		2X7–8250
	8260.0 kc, channel 77.6		2X7–8260
	8270.0 kc, channel 77.7		2X7–8270
	8280.0 kc, channel 77.8		2X7–8280
	8290.0 kc, channel 77.9		2X7–8290
	8300.0 kc, channel 78.0		2X7–8300
	8310.0 kc, channel 78.1		2X7–8310
	8320.0 kc, channel 78.2		2X7–8320
	8330.0 kc, channel 78.3		2X7–8330
	8340.0 kc, channel 78.4		2X7–8340
	8350.0 kc, channel 78.5		2X7–8350
	8360.0 kc, channel 78.6		2X7–8360
	8370.0 kc, channel 78.7		2X7–8370
	8380.0 kc, channel 78.8		2X7–8380
	8390.0 kc, channel 78.9		2X7–8390
	8400.0 kc, channel 79.0		2X7–8400
	8410.0 kc, channel 79.1		2X7–8410
	8420.0 kc, channel 79.2		2X7–8420
	8430.0 kc, channel 79.3		2X7–8430
	8440.0 kc, channel 79.4		2X7–8440
	8450.0 kc, channel 79.5		2X7–8450
	8460.0 kc, channel 79.6		2X7–8460

19. Identification Table of Parts for Crystal Unit Set 2X13.1–12—(Continued)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	8470.0 kc, channel 79.7		2X7–8470
	8480.0 kc, channel 79.8		2X7–8480
	8490.0 kc, channel 79.9		2X7–8490
	8500.0 kc, channel 80.0		2X7–8500
	8510.0 kc, channel 80.1		2X7–8510
	8520.0 kc, channel 80.2		2X7–8520
	8530.0 kc, channel 80.3		2X7–8530
	8540.0 kc, channel 80.4		2X7–8540
	8550.0 kc, channel 80.5		2X7–8550
	8560.0 kc, channel 80.6		2X7–8560
	8570.0 kc, channel 80.7		2X7–8570
	8580.0 kc, channel 80.8		2X7–8580
	8590.0 kc, channel 80.9		2X7–8590
	8600.0 kc, channel 81.0		2X7–8600
	8610.0 kc, channel 81.1		2X7–8610
	8620.0 kc, channel 81.2		2X7–8620
	8630.0 kc, channel 81.3		2X7–8630
	8640.0 kc, channel 81.4		2X7–8640
	8650.0 kc, channel 81.5		2X7–8650
	8660.0 kc, channel 81.6		2X7–8660
	8670.0 kc, channel 81.7		2X7–8670
	8680.0 kc, channel 81.8		2X7–8680
	8690.0 kc, channel 81.9		2X7–8690
	8700.0 kc, channel 82.0		2X7–8700
	8710.0 kc, channel 82.1		2X7–8710
	8720.0 kc, channel 82.2		2X7–8720
	8730.0 kc, channel 82.3		2X7–8730
	8740.0 kc, channel 82.4		2X7–8740
	8750.0 kc, channel 82.5		2X7–8750
	7300.0 kc, channel 82.6		2X7–7300
	7308.3 kc, channel 82.7		2X7–7308.3
	7316.7 kc, channel 82.8		2X7–7316.7
	7325.0 kc, channel 82.9		2X7–7325
	7333.3 kc, channel 83.0		2X7–7333.3
	7341.7 kc, channel 83.1		2X7–7341.7
	7350.0 kc, channel 83.2		2X7–7350
	7358.3 kc, channel 83.3		2X7–7358.3
	7366.7 kc, channel 83.4		2X7–7366.7
	7375.0 kc, channel 83.5		2X7–7375
	7383.3 kc, channel 83.6		2X7–7383.3
	7391.7 kc, channel 83.7		2X7–7391.7
	7400.0 kc, channel 83.8		2X7–7400
	7408.3 kc, channel 83.9		2X7–7408.3
	7416.7 kc, channel 84.0		2X7–7416.7
	7425.0 kc, channel 84.1		2X7–7425
	7433.3 kc, channel 84.2		2X7–7433.3
	7441.7 kc, channel 84.3		2X7–7441.7
	7450.0 kc, channel 84.4		2X7–7450
	7458.3 kc, channel 84.5		2X7–7458.3
	7466.7 kc, channel 84.6		2X7–7466.7
	7475.0 kc, channel 84.7		2X7–7475
	7483.3 kc, channel 84.8		2X7–7483.3
	7491.7 kc, channel 84.9		2X7–7491.7
	7500.0 kc, channel 85.0		2X7–7500
	7508.3 kc, channel 85.1		2X7–7508.3
	7516.7 kc, channel 85.2		2X7–7516.7
	7525.0 kc, channel 85.3		2X7–7525
	7533.3 kc, channel 85.4		2X7–7533.3

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	7541.7 kc, channel 85.5		2X7–7541.7
	7550.0 kc, channel 85.6		2X7–7550
	7558.3 kc, channel 85.7		2X7–7558.3
	7566.7 kc, channel 85.8		2X7–7566.7
	7575.0 kc, channel 85.9		2X7–7575
	7583.3 kc, channel 86.0		2X7–7583.3
	7591.7 kc, channel 86.1		2X7–7591.7
	7600.0 kc, channel 86.2		2X7–7600
	7608.3 kc, channel 86.3		2X7–7608.3
	7616.7 kc, channel 86.4		2X7–7616.7
	7625.0 kc, channel 86.5		2X7–7625
	7633.3 kc, channel 86.6		2X7–7633.3
	7641.7 kc, channel 86.7		2X7–7641.7
	7650.0 kc, channel 86.8		2X7–7650
	7658.3 kc, channel 86.9		2X7–7658.3
	7666.7 kc, channel 87.0		2X7–7666.7
	7675.0 kc, channel 87.1		2X7–7675
	7683.3 kc, channel 87.2		2X7–7683.3
	7691.7 kc, channel 87.3		2X7–7691.7
	7700.0 kc, channel 87.4		2X7–7700
	7708.3 kc, channel 87.5		2X7–7708.3
	7716.7 kc, channel 87.6		2X7–7716.7
	7725.0 kc, channel 87.7		2X7–7725
	7733.3 kc, channel 87.8		2X7–7733.3
	7741.7 kc, channel 87.9		2X7–7741.7
	7750.0 kc, channel 88.0		2X7–7750
	7758.3 kc, channel 88.1		2X7–7758.3
	7766.7 kc, channel 88.2		2X7–7766.7
	7775.0 kc, channel 88.3		2X7–7750
	7783.3 kc, channel 88.4		2X7–7783.3
	7791.7 kc, channel 88.5		2X7–7791.7
	7800.0 kc, channel 88.6		2X7–7800
	7808.3 kc, channel 88.7		2X7–7808.3
	7816.7 kc, channel 88.8		2X7–7816.7
	7825.0 kc, channel 88.9		2X7–7825
	7833.3 kc, channel 89.0		2X7–7833.3
	7841.7 kc, channel 89.1		2X7–7841.7
	7850.0 kc, channel 89.2		2X7–7850
	7858.3 kc, channel 89.3		2X7–7858.3
	7866.7 kc, channel 89.4		2X7–7866.7
	7875.0 kc, channel 89.5		2X7–7875
	7883.3 kc, channel 89.6		2X7–7883.3
	7891.7 kc, channel 89.7		2X7–7891.7
	7900.0 kc, channel 89.8		2X7–7900
	7908.3 kc, channel 89.9		2X7–7908.3
	7916.7 kc, channel 90.0		2X7–7916.7
	7925.0 kc, channel 90.1		2X7–7925
	7933.3 kc, channel 90.2		2X7–7933.3
	7941.7 kc, channel 90.3		2X7–7941.7
	7950.0 kc, channel 90.4		2X7–7950
	7958.3 kc, channel 90.5		2X7–7958.3
	7966.7 kc, channel 90.6		2X7–7966.7
	7975.0 kc, channel 90.7		2X7–7975
	7983.3 kc, channel 90.8		2X7–7983.3
	7991.7 kc, channel 90.9		2X7–7991.7
	8000.0 kc, channel 91.0		2X7–8000
	8008.3 kc, channel 91.1		2X7–8008.3
	8016.7 kc, channel 91.2		2X7–8016.7

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Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	8025.0 kc, channel 91.3		2X7–8025
	8033.3 kc, channel 91.4		2X7–8033.3
	8041.7 kc, channel 91.5		2X7–8041.7
	8050.0 kc, channel 91.6		2X7–8050
	8058.3 kc, channel 91.7		2X7–8058.3
	8066.7 kc, channel 91.8		2X7–8066.7
	8075.0 kc, channel 91.9		2X7–8075
	8083.3 kc, channel 92.0		2X7–8083.3
	8091.7 kc, channel 92.1		2X7–8091.7
	8100.0 kc, channel 92.2		2X7–8100
	8108.3 kc, channel 92.3		2X7–8108.3
	8116.7 kc, channel 92.4		2X7–8116.7
	8125.0 kc, channel 92.5		2X7–8125
	8133.3 kc, channel 92.6		2X7–8133.3
	8141.7 kc, channel 92.7		2X7–8141.7
	8150.0 kc, channel 92.8		2X7–8150
	8158.3 kc, channel 92.9		2X7–8158.3
	8166.7 kc, channel 93.0		2X7–8166.7
	8175.0 kc, channel 93.1		2X7–8175
	8183.3 kc, channel 93.2		2X7–8183.3
	8191.7 kc, channel 93.3		2X7–8191.7
	8200.0 kc, channel 93.4		2X7–8200
	8208.3 kc, channel 93.5		2X7–8208.3
	8216.7 kc, channel 93.6		2X7–8216.7
	8225.0 kc, channel 93.7		2X7–8225
	8233.3 kc, channel 93.8		2X7–8233.3
	8241.7 kc, channel 93.9		2X7–8241.7
	8250.0 kc, channel 94.0		2X7–8250
	8258.3 kc, channel 94.1		2X7–8258.3
	8266.7 kc, channel 94.2		2X7–8266.7
	8275.0 kc, channel 94.3		2X7–8275
	8283.3 kc, channel 94.4		2X7–8283.3
	8291.7 kc, channel 94.5		2X7–8291.7
	8300.0 kc, channel 94.6		2X7–8300
	8308.3 kc, channel 94.7		2X7–8308.3
	8316.7 kc, channel 94.8		2X7–8316.7
	8325.0 kc, channel 94.9		2X7–8325
	8333.3 kc, channel 95.0		2X7–8333.3
	8341.7 kc, channel 95.1		2X7–8341.7
	8350.0 kc, channel 95.2		2X7–8350
	8358.3 kc, channel 95.3		2X7–8358.3
	8366.7 kc, channel 95.4		2X7–8366.7
	8375.0 kc, channel 95.5		2X7–8375
	8383.3 kc, channel 95.6		2X7–8383.3
	8391.7 kc, channel 95.7		2X7–8391.7
	8400.0 kc, channel 95.8		2X7–8400
	8408.3 kc, channel 95.9		2X7–8408.3
	8416.7 kc, channel 96.0		2X7–8416.7
	8425.0 kc, channel 96.1		2X7–8425
	8433.3 kc, channel 96.2		2X7–8433.3
	8441.7 kc, channel 96.3		2X7–8441.7
	8450.0 kc, channel 96.4		2X7–8450
	8458.3 kc, channel 96.5		2X7–8458.3
	8466.7 kc, channel 96.6		2X7–8466.7
	8475.0 kc, channel 96.7		2X7–8475
	8483.3 kc, channel 96.8		2X7–8483.3
	8491.7 kc, channel 96.9		2X7–8491.7
	8500.0 kc, channel 97.0		2X7–8500
	8508.3 kc, channel 97.1		2X7–8508.3

19. Identification Table of Parts for Crystal Unit Set 2X13.1–12—(Continued)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	8516.7 kc, channel 97.2		2X7–8516.7
	8525.0 kc, channel 97.3		2X7–8525
	8533.3 kc, channel 97.4		2X7–8533.3
	8541.7 kc, channel 97.5		2X7–8541.7
	8550.0 kc, channel 97.6		2X7–8550
	8558.3 kc, channel 97.7		2X7–8558.3
	8566.7 kc, channel 97.8		2X7–8566.7
	8575.0 kc, channel 97.9		2X7–8575
	8583.3 kc, channel 98.0		2X7–8583.3
	8591.7 kc, channel 98.1		2X7–8591.7
	8600.0 kc, channel 98.2		2X7–8600
	8608.3 kc, channel 98.3		2X7–8608.3
	8616.7 kc, channel 98.4		2X7–8616.7
	8625.0 kc, channel 98.5		2X7–8625
	8633.3 kc, channel 98.6		2X7–8633.3
	8641.7 kc, channel 98.7		2X7–8641.7
	8650.0 kc, channel 98.8		2X7–8650
	8658.3 kc, channel 98.9		2X7–8658.3
	8666.7 kc, channel 99.0		2X7–8666.7
	8675.0 kc, channel 99.1		2X7–8675
	8683.3 kc, channel 99.2		2X7–8683.3
	8691.7 kc, channel 99.3		2X7–8691.7
	8700.0 kc, channel 99.4		2X7–8700
	8708.3 kc, channel 99.5		2X7–8708.3
	8716.7 kc, channel 99.6		2X7–8716.7
	8725.0 kc, channel 99.7		2X7–8725
	8733.3 kc, channel 99.8		2X7–8733.3
	8741.7 kc, channel 99.9		2X7–8741.7
	Stored in Case CY–44/TRC–3; Hallicrafters part #117X045.		

20. Identification Table of Parts for Crystal Unit Set 2X13.1–9

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CRYSTAL UNIT SET, quartz: for freq determination of xmtr and rec; c/o 16 Army-Navy Crystal Units CR–4B/U and 16 Army-Navy Crystal Units CR–6B/U; stored in Case CY–67/TRC–1; Hallicrafters part #117X006 and Hallicrafters part #117X005.	Frequency controlling crystals for Army Field Forces outside zone of interior.	2X13.1–9
	CASE: Army-Navy Case CY–67/TRC–1; steel, olive drab finish; 7⅛″ lg x 4⅝″ wd x 2⅛″ h o/a; bottom felt lined w/ punched holes to receive xtal prongs; Hallicrafters part/dwg #66C569; Sig C dwg #SC–C–32295.	Crystal storage	2Z1891–67
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–4B/U; c/o 16 xtal units, freq as follows:	For frequency control of transmitter	2X13.1–4
	741.667 kc, channel 71.2		2X13–712
	752.083 kc, channel 72.2		2X13–722
	758.333 kc, channel 72.8		2X13–728
	764.583 kc, channel 73.4		2X13–734
	770.883 kc, channel 74.0		2X13–740
	785.417 kc, channel 75.4		2X13–754
	791.667 kc, channel 76.0		2X13–760
	812.500 kc, channel 78.0		2X13–780
	943.750 kc, channel 90.6		2X13–906
	968.750 kc, channel 93.0		2X13–930

20. Identification Table of Parts for Crystal Unit Set 2X13.1–9—(Continued)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	977.083 kc, channel 93.8		2X13–938
	993.750 kc, channel 95.4		2X13–954
	1008.333 kc, channel 96.8		2X13–968
	1020.833 kc, channel 98.0		2X13–980
	1029.167 kc, channel 98.8		2X13–988
	1037.500 kc, channel 99.6		2X13–996
	stored in steel case; Hallicrafters part #117X006.		
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–6B/U; c/o 16 xtal units, freq as follows:	For frequency control of receiver.	
	7620.0 kc, channel 71.2		2X7–7620
	7720.0 kc, channel 72.2		2X7–7720
	7780.0 kc, channel 72.8		2X7–7780
	7840.0 kc, channel 73.4		2X7–7840
	7900.0 kc, channel 74.0		2X7–7900
	7966.7 kc, channel 90.6		2X7–7966.7
	8040.0 kc, channel 75.4		2X7–8040
	8100.0 kc, channel 76.0		2X7–8100
	8166.7 kc, channel 93.0		2X7–8166.7
	8233.3 kc, channel 93.8		2X7–8233.3
	8300.0 kc, channel 78.0		2X7–8300
	8366.7 kc, channel 95.4		2X7–8366.7
	8483.3 kc, channel 96.8		2X7–8483.3
	8583.3 kc, channel 98.0		2X7–8583.3
	8650.0 kc, channel 98.8		2X7–8650
	8716.7 kc, channel 99.6		2X7–8716.7
	stored in steel case; Hallicrafters part #117X005.		

21. Identification Table of Parts for USN Crystal Set for Outside ZI

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CRYSTAL UNIT SET, quartz: for freq determination of xmtr and rec; c/o 6 Army-Navy Crystal Units CR–4B/U and 6 Army-Navy Crystal Units CR–6B/U; stored in Case CY–67/TRC–1, 7⅛″ lg x 4⅝″ wd x 2⅛″ h o/a.	Frequency controlling crystals for use of USN outside zone of interior.	
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–4B/U; c/o 1 ea xtal units, freq as follows:	For frequency control of transmitter.	
	734.375 kc, channel 70.5		2X13–705
	765.625 kc, channel 73.5		2X13–735
	796.875 kc, channel 76.5		2X13–765
	828.125 kc, channel 79.5		2X13–795
	939.583 kc, channel 90.2		2X13–902
	985.417 kc, channel 94.6		2X13–946
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–6B/U; c/o 1 ea xtal units, freq as follows:	For frequency control of receiver.	
	7550.0 kc, channel 70.5		2X7–7550
	7850.0 kc, channel 73.5		2X7–7850
	8150.0 kc, channel 76.5		2X7–8150
	8450.0 kc, channel 79.5		2X7–8450
	7933.3 kc, channel 90.2		2X7–7933.3
	8300.0 kc, channel 94.6		2X7–8300

22. Identification Table of Parts for AAF Crystal Unit Set for Outside ZI

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CRYSTAL UNIT SET, quartz: for freq determination of xmtr and rec; c/o 4 Army-Navy Crystal Units CR–4B/U and 4 Army-Navy Crystal Units CR–6B/U; stored in Case CY–67/TRC–1, 7⅛″ lg x 4⅝″ wd x 2⅛″ h o/a.	Frequency controlling crystals for use of AAF outside zone of interior.	
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–4B/U; c/o 4 xtal units, freq as follows:	For frequency control of transmitter.	
	731.250 kc, channel 70.2		2X13–702
	828.125 kc, channel 79.5		2X13–795
	954.167 kc, channel 91.6		2X13–916
	1027.083 kc, channel 98.6		2X13–986
	CRYSTAL UNIT SET, quartz: Army-Navy Crystal Units CR–6B/U; c/o 4 xtal units, freq as follows:	For frequency control of receiver.	
	7520 kc, channel 70.2		2X7–7520
	8450 kc, channel 79.5		2X7–8450
	8050 kc, channel 91.6		2X7–8050
	8633.3 kc, channel 98.6		2X7–8633.3

APPENDIX III
TABLES OF COMPONENTS

1. Radio Set AN/TRC–1(*)

Most of the small items not furnished separately with the G model are included in Accessory Kit No. 1.

Components	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R–19(*)/TRC–1	1	8	12¾	19⅛	1.07	43
Radio Transmitter T–14(*)/TRC–1	1	10¾	12¾	19⅛	1.46	66
Antenna System AS–19(*)/TRC–1 (see par. 5 of this appendix).						
Antenna Extension Kit MX–141(*)/TRC–1 for use with unlettered, A, B, or C model of Antenna System AS–19(*)/TRC–1, (In cloth bag)	1					14
Power Unit PE–75–(*), with 2 TM 11–900	1	26½	19½	36	10.7	330
Crystal kit (see par. 6 of this appendix).						
Headset HS–30–(*) (not furnished with unlettered, A, B, or G model)	1					.6
Microphone T–45–(*) (not furnished with unlettered, A, B, or G model)	1					.2
Junction Box JB–110 (not furnished with G model)	2	3	5	12½	.11	7
Cord CD–318 (not furnished with G model)	1			84		.5
Cord CD–874 (not furnished with G model)	1			78		.5
Lamp, electric, 115, 50 w (not furnished with G model)	2					
Maintenance Equipment MK–4(*)/TRC–1 (not furnished with G model) (see par. 8 of this appendix).						
Accessory Kit No. 1 (G model only) (see par. 7 of this appendix)						

2. Radio Terminal Set AN/TRC–3(*)

Most of the small items not furnished separately with the G model are included in Accessory Kits Nos. 1 and 2.

Components	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R–19(*)/TRC–1	2	8	12¾	19⅛	1.07	43
Radio Transmitter T–14(*)/TRC–1	2	10¾	12¾	19⅛	1.46	66
Antenna System AS–19(*)/TRC–1 (see par. 5 of this appendix)						
Maintenance Equipment MK–5(*)/TRC–3 (not issued with G model) (see par. 9 of this appendix)	1					
Accessory Kit No. 1 (with G model only) (see par. 7 of this appendix)	1					
Accessory Kit No. 2 (with G model only) (see par. 7 of this appendix)	1					
Multimeter TS–297(*)/U (with G model only)	1					
Multimeter TS–352(*)/U (with G model only)	1					
Tube Tester I–177–(*) (with G model only)	1					
Crystal kit (see par. 6 of this appendix).						
Power Unit PE–75–(*), with 2 TM 11–900	4	26½	19½	36	10.7	330
Cord CD–318 (not furnished with G model)	2			84		.5
Cord CD–800 (40-inch) (not furnished with G model)	1			40		.7
Cord CD–874 (not furnished with G model)	2			78		.5
Cord CX–8/TRC–1 or CX–104/TRC–1 (not furnished with G model)	1			120		1.5

2. Radio Terminal Set AN/TRC-3(*)—(Continued)

Components	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Soldering Iron TL-117 with 6-foot cord (not furnished with G model)	1					
Handset H-23(*)/U, TS-13-(*), or TS-15-(*) (not furnished with G model)	1					1.8
Headset HS-30-(*) (not furnished with unlettered, A, B, or G model)	2					.6
Microphone T-45-(*) (not furnished with unlettered, A, B, or G model)	2					.2
Telephone EE-8-(*), with TM 11-333 (not furnished with G model)	3	$9\frac{9}{16}$	$3\frac{1}{2}$	$7\frac{11}{16}$	.21	9.75
Junction Box J-85/G (not furnished with G model)	2	$4\frac{1}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$	.06	8
Junction Box JB-110 (not furnished with G model)	1	3	5	$12\frac{1}{2}$	.11	7
Tube puller (not furnished with G model)	1			$7\frac{1}{8}$	.06	.1

3. Radio Relay Set AN/TRC-4(*)

Most of the small items not furnished separately with the G model are included in Accessory Kits Nos. 1, 2, and 3.

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R-19(*)/TRC-1 (4 furnished with G model)	3	8	$12\frac{3}{4}$	$19\frac{1}{8}$	1.07	43
Radio Transmitter T-14(*)/TRC-1 (4 furnished with G model)	3	$10\frac{3}{4}$	$12\frac{3}{4}$	$19\frac{1}{8}$	1.46	66
Antenna System AS-19(*)/TRC-1 (see par. 5 of this appendix)						
Control Box C-21(*)/TRC-1 (not furnished with G model)	1	$2\frac{1}{8}$	$3\frac{1}{4}$	$4\frac{7}{8}$		
Power Unit PE-75-(*)	4	$26\frac{1}{2}$	$19\frac{1}{2}$	36	10.7	330
Test Oscillator TS-32(*)/TRC-1 (not furnished with G model)	1	$4\frac{3}{4}$	4	7	.08	3
Handset H-23(*)/U, TS-13-(*), or TS-15-(*) (not furnished with G model)	2					1.8
Headset HS-30-(*) (not furnished with unlettered, A, B, or G model)	3					.6
Microphone T-45-(*) (not furnished with unlettered, A, B, or G Model)	3					.2
Telephone EE-8-(*) (not furnished with G model)	3	$9\frac{9}{16}$	$3\frac{1}{2}$	$7\frac{11}{16}$	.21	9.75
Junction Box J-85/G (not furnished with G model)	3	$4\frac{1}{8}$	$5\frac{1}{2}$	$4\frac{3}{8}$		8
Junction Box JB-110 (not furnished with G model)	1	3	5	$12\frac{1}{2}$	.11	7
Alinement tool (not furnished with G model).	1			$6\frac{5}{8}$		.1
Tube puller (not furnished with G model).	3			$7\frac{1}{8}$		.2
Maintenance Kit MK-6(*)/TRC-4 (not issued with G model) (see par. 10 of this appendix).	1					
Accessory Kit No. 1 (with G model only) (see par. 7 of this appendix).	1					
Accessory Kit No. 2 (with G model only) (see par. 7 of this appendix).	1					
Accessory Kit No. 3 (supplied on Order Nos. 1621-Phila-49 and 24689-Phila-49 only) (see par. 7 of this appendix).	1					
Multimeter TS-297(*)/U (with G model only).	1					
Multimeter TS-352(*)/U (with G model only).	1					
Tube Tester I-177-(*) (with G model only).	1					
Cord CD-318 (not furnished with G model).	3			84		.5
Cord CD-711 (not furnished with G model).	1			600		10
Cord CD-800 (40-inch) (not furnished with G model).	2			40		.7
Cord CD-874 (not furnished with G model).	3			78		.5

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3. Radio Relay Set AN/TRC–4(*)—(Continued)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Cord CX–8/TRC–1 or CX–104/TRC–1 (not furnished with G model)	2			120		1.5
Knife TL–29 (not furnished with G model)	1			3⅝		
Pliers TL–103 (not furnished with G model)	1			5		
Soldering Iron TL–117 with 6-foot cord (not furnished with G model)	1					
Flashlight TL–122 (not furnished with G model)	1					
Pliers TL–125 (not furnished with G model)	1			8		
Pliers TL–126 (not furnished with G model)	1			6		

4. Amplifier Equipment AN/TRA–1(*)

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Amplifier AM–8(*)/TRA–1	1	10¾	12¾	19⅛	1.46	48
Power Supply PP–13(*)/TRA–1	1	9⅜	14	25	1.90	130
Spare Parts Kit MK–11(*)/TRA–1	1	18½	15½	30	4.98	90
Cord CD–800 (40-inch)	1			40		.7

5. Antenna System AS–19(*)/TRC–1

a. Quantities Used. Each *antenna system* is composed of one Antenna AS–20(*)/TRC–1 and one Antenna Support AB–33(*)/TRC–1. Unlettered and A models of the *antenna support* are 40 feet high; they can be extended to 50 feet by the addition of Antenna Extension Kit MX–141/TRC–1. B and C models of the antenna support are approximately 50 feet high. The different sets use the following quantities of Antenna Systems AS–19(*)/TRC–1:

Set	*Quantity*
Radio Sets AN/TRC–1 thru AN/TRC–1E	3 systems
Radio Set AN/TRC–1G for Navy operation outside Z1	3 systems
Radio Set AN/TRC–1G for all other operations	2 systems
Radio Terminal Set AN/TRC–3(*)	3 systems
Radio Relay Sets AN/TRC–4 thru AN/TRC–4E	6 systems
Radio Relay Set AN/TRC–4G	5 systems

b. Packaging. Unlettered through D models of Antenna System AS–19(*)/TRC–1 are packed in Case CY–29(*)/TRC–1 and Case CY–30(*)/TRC–1. E and F models of the antenna system are packed in Case CY–444/TRC–1, Carrying Frame CY–445/TRC–1, four Cases CY–443/TRC–1, and two Bags BG–102–(*). Case CY–790/TRC–1 was used in place of Case CY–444/TRC–1 in early procurements of the F model. *Two* cases CY–443/TRC–1 are used together to form *one* package of seven mast sections. Two such packages are needed for each antenna support. Following is the size, volume, and packed weight of the various packaging items:

Item	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Weight (lb)
Bag BG–102–(*)	16	9	18	1.5	40
Case CY–29(*)/TRC–1	13¼	17½	72	9.6	380
Case CY–30(*)/TRC–1	13⅛	16	33½	4.1	90
Case CY–443/TRC–1	16½	11$\frac{5}{16}$	69	7.5	77
Case CY–444/TRC–1	13½	19½	38½	5.9	103
Carrying Frame CY–445/TRC–1	13½	3¼	36¾	.93	87.5
Case CY–790/TRC–1	13½	19½	38½	5.9	103

c. COMPONENTS. The various models of the antenna *systems* have the following components:

Item	Model							Unit weight (lb)
	Unlettered	A	B	C	D	E	F	
Adapter, mast head assembly	1							
Axe LC–1	1	1	1	1	1	1	1	6.75.
Bag BG–102–(*)						2	2	40 packed.
Block, pulley, 1½″, double-sheave w/snaphook		1	1	1				0.7.
Block, pulley, 1½″, single-sheave, w/ring		1	1	1				1.
Block, pulley, 3″, double-sheave	1							2.
Block, pulley, 4″, single-sheave	1							3.
Block and tackle assembly					1	1	1	9.
Bolts, carriage, ½″ x 6″	4	4						0.5.
Carrying Frame CY–445/TRC–1						1	1	87.5 packed.
Case CY–29(*)/TRC–1	1	1	1	1	1			275 to 348 packed.
Case CY–30(*)/TRC–1	1	1	1	1	1			75 to 117 packed.
Case CY–443/TRC–1						4	4	77 packed.
Case CY–444/TRC–1 or CY–790/TRC–1						1	1	103 packed.
Collet, dipole ring			8	8	6			0.01.
Cord CD–800 or CG–107/U (15 ft 6 in.)					4	4		2.
Cord CD–800 or CG–107/U (35 feet)							1	7.
Cord CD–800 or CG–107/U (50 feet)	4	4	4	4	4	4		5.75.
Cord CD–800 or CG–107/U (65 feet)							3	4.
Dipole element	8	8	8	8	8	8	8	0.6.
Drill, star, ⅝″ x 12″	1							0.7.
Drill, star, ¾″ x 12″		1	1	1				0.9.
Guy assembly, 40 feet, nylon (one is a spare)	4							0.8.
Guy assembly, 37 feet, stainless steel				5				
Guy assembly, 50 feet, stainless steel				5				1.
Guy MX–555/U, 37 feet, nylon		5	5		5	5	5	1.
Guy MX–555/U, 50 feet, nylon		5	5		5	5	5	1.
Guy MX–555/U, 60 feet, nylon (one is a spare in unlettered model)	4				5		4	1.2.
Guy Plate MX–552/TRC–1	2	4	4	4	6	6	6	0.2.
Hammer HM–1	1	1					1	2.5.
Hammer HM–2			1	1	1			4.4.
Hammer HM–3	1	1	1	1	1	1	1	9.75.
Hook, S, ⅜″ x 4½″		3						0.2.
Insulator Assembly, dipole	2	2	2	2	2	1		0.4.
Lubricant, tube			1	1	1			0.1.
Mast Base AB–102/TRC–1	1	1	1	1	1	1	1	22.
Mast extension							3 or 4	4.
Mast head assembly	1	1	1	1	1	1	1	3.5.
Mast Section AB–101/TRC–1	11	11	11	11	14	14	14	10.
Nut, collet, dipole coupling			8	8	3			0.04.
Plug PL–258	4	4	4	4	4	4	4	0.1.
Plug PL–259	4	4						
Ring-Snap Assembly MX–553/TRC–1			8	8	9	9	9	0.8.
Rope, ⅜″ x 150′	1	1	1	1				6.3.
Scissors horse		1	1	1	1	1		6.5.
Sledge handle and wedge, spare			1	1	1	1	1	1.
Stake GP–2		5	5	5	5	5	5	2.
Stake GP–25	6	6	6	6	6	6	6	9.25.
Strap ST–18	4	4	4	4	4			0.4.
Support member, parasitic	3	3	3	3	3	3	2	2.5.
Tag MC–72	12	12	12	12	12	12	12	
Tape TL–83, friction	4	4	4	4	4	4	4	0.6.

Item	Model: Unlettered	A	B	C	D	E	F	Unit weight (lb)
Tape TL–94, rubber	4	4	4	4	4			0.4.
Tape TL–192						4	4	0.4.
Wrench, open-end, ¾″ and 1⅛″					2	2		0.4.
Wrench, open-end, ¾″	1	1						0.4.
Wrench, open-end, 25/32″ and 15/32″			2	2			1	0.4.
Wrench, open-end, 1⅛″	1	1						0.4.

6. Crystal Set Packaging

Crystal sets are issued in four types of packages. (Packaging may differ from the four types described below in certain procurements.)

Set	Package	Xmtr Freqs	Xmtr xtals ea. freq	Rec freqs	Rec xtals ea. freq	Total xtals
A	Case CY–67/TRC–1	4	1	4	1	8
B	Case CY–67/TRC–1	6	1	6	1	12
C	Case CY–67/TRC–1	16	2	16	1	48
D	Case CY–44/TRC–1	300	2	300	1	900

a. Set A is used for Army Air Forces outside ZI.

b. Set B is used for Navy outside ZI.

c. Set C is used for Army Field Forces outside ZI.

d. Set D is used at terminals of multichannel relay systems and, occasionally, at the relay stations.

e. Appendix II lists the individual crystal frequencies.

f. Crystals mounted in Crystal Holder FT–243 (usually tan or brown) are the equivalent of Crystal Units CR–6/U. Crystals mounted in Crystal Holder FT–241–A (usually red) are equivalent to Crystal Unit CR–4/U. The physically larger units are transmitter crystals.

7. Accessory Kits

Five types of accessory kits were issued: early and late No. 1, early and late No. 2, and No. 3. Variations of the accessory kits were made on different procurements. Most changes consisted of considering an item such as a headset or handset a part of the accessory kit or a part of the radio set. Early kits were packed in Chest BC–5; late kits were packed in Chest CY–64(*)/TRC–1. Paragraphs 13 through 15 of appendix II list the contents of the most widely procured types. Accessory kits were issued only with Radio Sets AN/TRC–1G, Radio Terminal Sets AN/TRC–3G, and Radio Relay Sets AN/TRC–4G.

8. Maintenance Equipment MK–4(*)/TRC–1

These maintenance equipments were issued with the unlettered through E models of Radio Set AN/TRC–1(*).

1 set	Vacuum tubes, spare, for Radio Receiver R–19(*)/TRC–1
1 set	Vacuum tubes, spare, for Radio Transmitter T–14(*)/TRC–1
1 set	Vacuum tubes, spare, for Test Oscillator TS–32(*)/TRC–1
1 ea	Every cable connector used
1 ea	Alignment Tool TL–207, modified
1 ea	Handset H–23/U
1 ea	Headset HS–30–(*)
1 ea	Microphone T–45
1 ea	Every type cable and/or cord used
1 ea	Every type r-f coil assembly used
1 ea	Every type i-f coil assembly used
12 ea	Every dust filter used
6 ea	Every type fuse used
1 ea	Every type fuseholder used
2 ea	Every type ceramic insulator used
2 ea	Every type pilot lamp used
1 ea	Every type relay used
2 ea	Every type switch used
2 ea	Every ventilating fan and motor used
1 ea	Lamp, trouble, 115-volt with 25-foot cord
2 ea	Bulb, 50-watt, 115-volt (spare for trouble lamp)
1 ea	Every type thermostat used
1 ea	Every type dry rectifier used

1 ea Every crystal heater used
1 set Cable terminals
1 ea Every electrolytic capacitor
1 ea Test Oscillator TS–32(*)/TRC–1

50 percent, but not less than 1 of each type fixed and variable resistors; fixed paper, mica, and variable air capacitors; and r-f choke coils.

Miscellaneous items, such as tube pullers and binding posts.

9. Maintenance Equipment MK–5(*)/TRC–3

These maintenance equipments were issued with the unlettered through E models of Radio Terminal Set AN/TRC–3(*).

Tubes for R–19(*)/TRC–1:

3 ea	Tube, 6AC7
2 ea	Tube, 6H6
7 ea	Tube, 6SH7
1 ea	Tube, 6SL7GT
1 ea	Tube, 6SN7GT
1 ea	Tube, 6V6GT
2 ea	Tube, 6X5GT (1 ea with R–19/TRC–1 and R–19A/TRC–1)

Tubes for TS–32(*)/TRC–1:

1 ea	Tube, 6SN7GT
1 ea	Tube, 6SH7
1 ea	Tube, 6SL7GT

Tubes for T–14(*)/TRC–1:

2 ea	Tube, 5R4GY (with lettered models only)
1 ea	Tube, 6SL7GT
1 ea	Tube, 6SN7GT
2 ea	Tube, 6AC7
4 ea	Tube, 6V6GT
1 ea	Tube, 829B
2 ea	Tube, 816 (with unlettered model only)
1 ea	Every cable connector used
1 ea	Every type cable and/or cord used
1 ea	Every type r-f coil assembly used
1 ea	Every type i-f coil assembly used
10 ea	Every type dust filter used
10 ea	Every type fuse used
1 ea	Every type fuseholder used
2 ea	Every type ceramic insulator used
2 ea	Every type pilot lamp used
1 ea	Every type relay used
2 ea	Every type switch used
1 ea	Every ventilating fan used
1 ea	Every type thermostat used
1 ea	Every type dry rectifier used
1 ea	Every crystal heater used
1 set	Cable terminals

50 percent, but not less than 1 of each type fixed and variable resistors, fixed paper and mica capacitors, and r-f choke coils.

1 ea	Every electrolytic capacitor
1 ea	Test Oscillator TS–32(*)/TRC–1, with operating tubes
1 ea	Alignment Tool TL–150 (modified)
1 ea	Knife TL–29
1 ea	Flashlight TL–122–(*)
1 ea	Pliers TL–125
1 ea	Pliers TL–103
1 ea	Pliers TL–126
2 lb	Solder M–31
1 ea	Soldering Iron TL–120
1 roll	Tape TL–83, friction
1 roll	Tape TL–94, rubber
2 ea	Bulb, 50-watt, 115-volt (spare for trouble lamp)
1 ea	Test Set I–56–K
1 ea	Lamp, trouble, 115-volt, with 25-foot cord
1 ea	Cord CD–711
1 ea	Junction Box JB–110.

10. Maintenance Equipment MK–6(*)/TRC–4

These maintenance equipments were issued with the unlettered through E models of Radio Relay Set AN/TRC–4(*).

Tubes for R–19(*)/TRC–1:

6 ea	Tube, 6AC7
4 ea	Tube, 6H6
14 ea	Tube, 6SH7
2 ea	Tube, 6SL7GT
2 ea	Tube, 6SN7GT
2 ea	Tube, 6X5GT
2 ea	Tube, 6V6GT

Tubes for TS–32(*)/TRC–1:

2 ea	Tube, 5R4GY (with lettered models only)
2 ea	Tube, 6SN7GT
2 ea	Tube, 6SH7
2 ea	Tube, 6SL7GT

Tubes for T–14(*)/TRC–1:

2 ea	Tube, 6SL7GT
2 ea	Tube, 6SN7GT
4 ea	Tube, 6AC7
8 ea	Tube, 6V6GT

2 ea	Tube JAN–829B
4 ea	Tube JAN–816 (with unlettered model only)
2 ea	Every cable connector used
1 ea	Every type of cable and cord used
2 ea	Every type r-f coil assembly used
2 ea	Every type i-f coil assembly used
12 ea	Every type dust filter used
12 ea	Every type fuse used
2 ea	Every type fuseholder used
4 ea	Every type ceramic insulator used
1 ea	Every type meter used
4 ea	Every type pilot lamp used
1 ea	Every type relay used
3 ea	Every type switch used
1 ea	Every type ventilating fan used
2 ea	Every type thermostat used
2 ea	Every type dry rectifier used
2 ea	Every crystal heater used
1 ea	Gear assembly for main tuning capacitor
1 set	Cable terminals

50 percent, but not less than 1 of each type fixed and variable resistors, fixed paper and mica capacitors, and r-f choke coils.

1 ea	Every electrolytic capacitor
1 ea	Test Oscillator TS–32(*)/TRC–1, with operating tubes
1 ea	Alignment Tool TL–150 (modified)
1 ea	Flashlight TL–122–(*)
1 ea	Knife TL–29
1 ea	Pliers TL–125
1 ea	Pliers TL–103
1 ea	Pliers TL–126
2 lb	Solder M–31
1 ea	Soldering Iron TL–120
1 roll	Tape TL–83, friction
1 roll	Tape TL–94, rubber
2 ea	Bulb, 50-watt, 115-volt (spare for trouble lamp)
1 ea	Test Set I–56–( )
1 ea	Lamp, trouble, 115-volt, with 25-foot cord
1 ea	Cord CD–711
1 ea	Junction Box JB–110

11. Spare Parts Kit MK–11(*)/TRA–1

These spare parts kits were issued with the unlettered through C models of Amplifier Equipment AN/TRA–1.

Spare tubes:

3 ea	Tube, 0D3
2 ea	Tube, 4E27
1 ea	Tube, 6X5GT
2 ea	Tube, 866A/866
1 ea	Every cable connector used
1 ea	Every cable and cord used
1 ea	Every r-f coil assembly used
10 sets	Every fuse used
1 ea	Every fuseholder used
3 ea	Every ceramic insulator used
1 ea	Every relay used
1 ea	Gear assembly for main tuning capacitor
3 sets	Every pilot lamp used
2 ea	Every switch used
1 ea	Every ventilating fan used
1 ea	Every thermostat used
6 ea	Every dust filter used

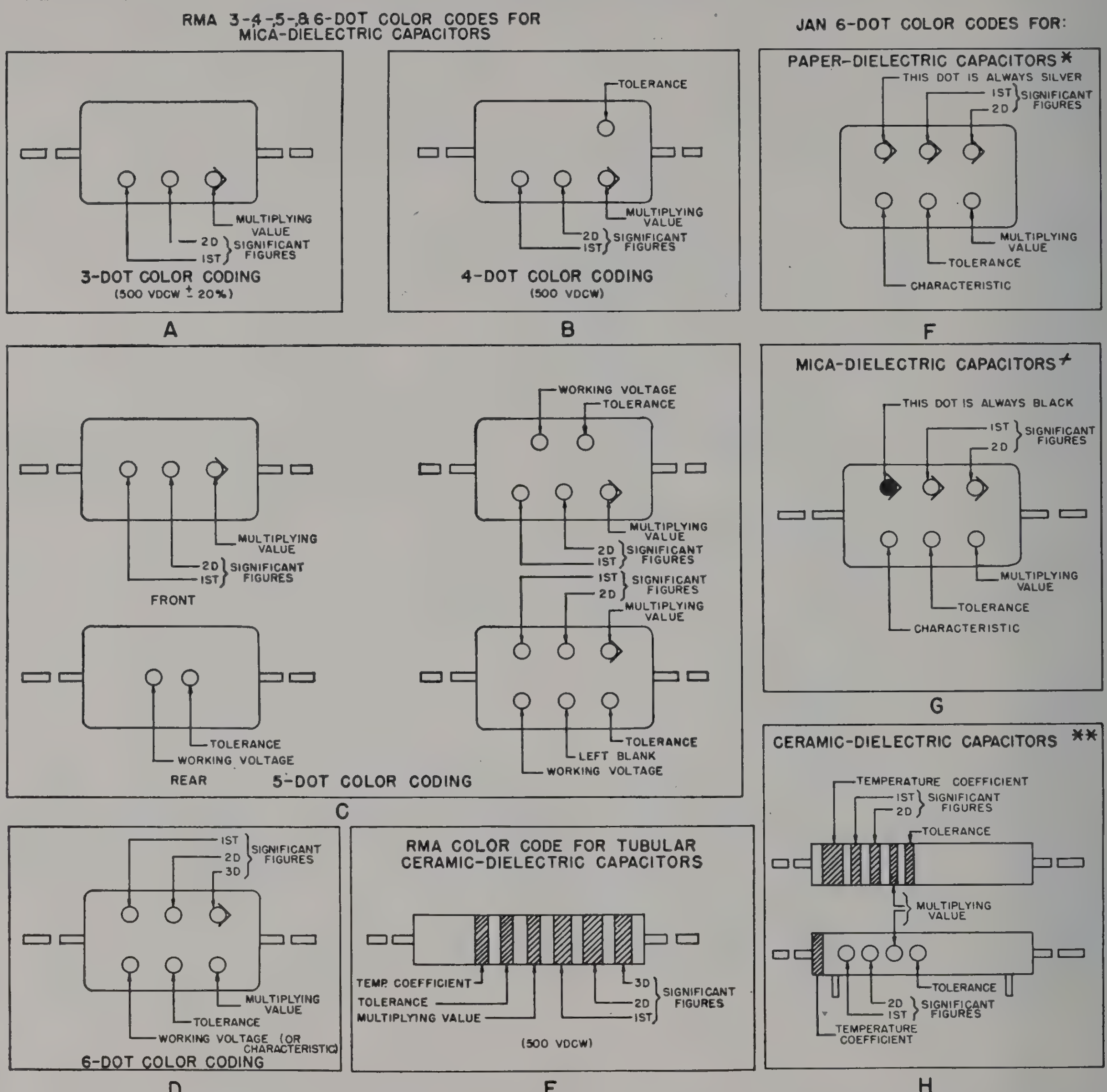
50 percent, but not less than 1 of each type fixed and variable resistors, fixed paper and mica capacitors, and r-f choke coils.

1 ea	Every electrolytic capacitor used

12. Table of Components for Power Unit PE–75–AD

Stock No.	Description
3H4575	Power Unit PE–75–AD.
6Z7500–0000	Abrasive; sheet; size #0000.
3H4575C/B17	Belt; "V," multiple drive; Manhattan Rubber Co. B42.
3H1901–AP/B8	Bowl; gas filter, Briggs & Stratton #68487, or equal.
3H4575C/B14	Brush; a-c, carbon, Leland A–3928–4, or equal.
3H4577A/C15	Capacitor; magneto, Briggs & Stratton part/dwg #290593, or equal.
6Q27460	Cleaner; point, $3\frac{1}{2}''$ lg; Jacobsen #06064, or equal.
3H4575C/B3	Exciter, brush, d-c Leland Electric #A–1633–4, or equal.
6Z4028–1	Funnel, plastic, cone shaped, $4\frac{3}{8}''$ OD x $4\frac{1}{16}''$ ID, $4\frac{3}{4}''$ overall stem $\frac{1}{2}''$ OD x $\frac{3}{8}''$ lg.
3H1901–A/P35	Contact point assembly; Basco #290301, or equal.
3H1909C/G4	Gasket, air cleaner, Briggs & Stratton #67247, or equal.
3H1909C/G6	Gasket, carburetor, Briggs & Stratton #27034, or equal.
3H1909C/G9	Gasket, elbow intake, Briggs & Stratton #65647, or equal.
3H1901–AP/G9	Gasket, fuel cleaner, Basco #68477, or equal.
	Gage; spark plug and ignition point, 6 leaf, sizes .015, .018, .020, .022, .025, .030. Kastar Mfg Co., or equal.
6Q49716	Hammer, machinists, 1 lb ball peen.
6R57430–1	Handle: wrench; "L" shape 1 arm of handle approx 10″ lg, other arm approx $3\frac{3}{4}''$ lg; $\frac{1}{2}''$ sq drive; Bonney Tool #4086, or equal.
3H4541.1/80	Key, machine; Woodruff #9B&S, No. 66403, or equal.
6R4721–6	Pliers, combination, slip joint, 6″ w/wire cutter, Krauter #356, or equal.
3H4411–5.1	Plug, spark, champion #5 COM, or equal.
3H4550/P36	Puller, wheel, Briggs & Stratton #29020, or equal.
3H1909C/R20	Rope and grip assembly, Briggs & Stratton #69932, or equal.
6R15621	Screw driver, 4″ blade.
6R16021	Screw driver, 6″ blade.
6R24308–18	Socket: wrench; 12 pt; $\frac{9}{16}''$ $\frac{1}{2}''$ sq drive.
6R24308–34	Socket: wrench; 12 pt; $1\frac{1}{16}''$; $\frac{1}{2}''$ sq drive.
	Technical Manual TM 11–900.
6R55018.1	Wrench: TL–476/U, Crescent Tool AC–18, or equal.
6R55112–12.1	Wrench: box and open end; $4\frac{1}{2}''$ lg; $\frac{3}{8}''$ opening each end; box end 12 pt; Plomb Tool #1212, or equal.
6R55114–14	Wrench: box and open end; $5\frac{1}{2}''$ lg; $\frac{7}{16}''$ openings each end, box end 12 pt; Plomb Tool #1214, or equal.
6R55116–16.1	Wrench: box and open end; $6\frac{1}{4}''$ lg; $\frac{1}{2}''$ openings each end; box end 12 pt; Plomb Tool #1216, or equal.
6R55118–18.1	Wrench: box and open end; 7″ lg; $\frac{9}{16}''$ openings each end; box end 12 pt; Plomb Tool #1218, or equal.
6R55508–8	Wrench: double end; $\frac{1}{4}''$ and $\frac{1}{4}''$ openings; 3″ lg J. H. Williams #1116, or equal.
6R57400–10	Wrench: hex "L" shape $\frac{5}{32}''$; Allen Mfg. Co., or equal.
6R57044	Wrench: single end, open; hex; $1\frac{3}{8}''$, Twin City Tool #C–678B, or equal.
6R59344	Wrench: spark plug Basco part/dwg #89721, or equal.

CAPACITOR COLOR CODES



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	–
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	–	0.1	0.1		1,000
SILVER	–	0.01	0.01		2,000
NO COLOR	–				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

✝ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

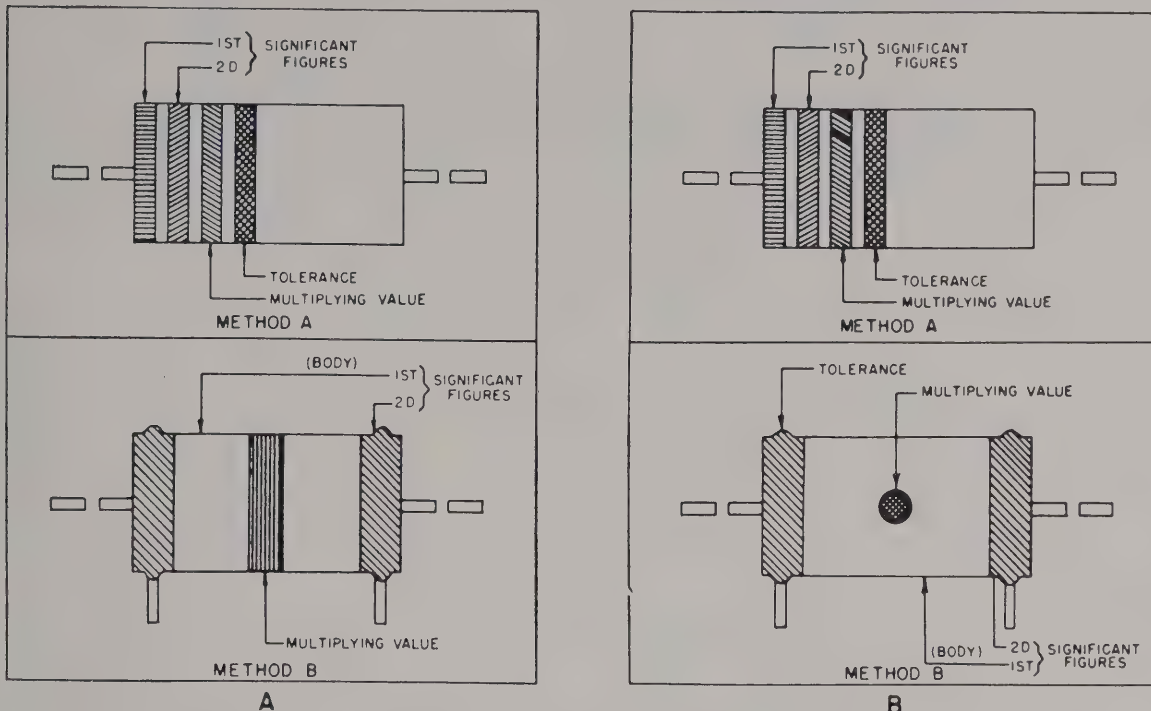
THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 32453S

Figure 178. Capacitor color codes.

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± -
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	—	0.1	± 5
SILVER	—	0.01	± 10
NO COLOR	—	—	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED

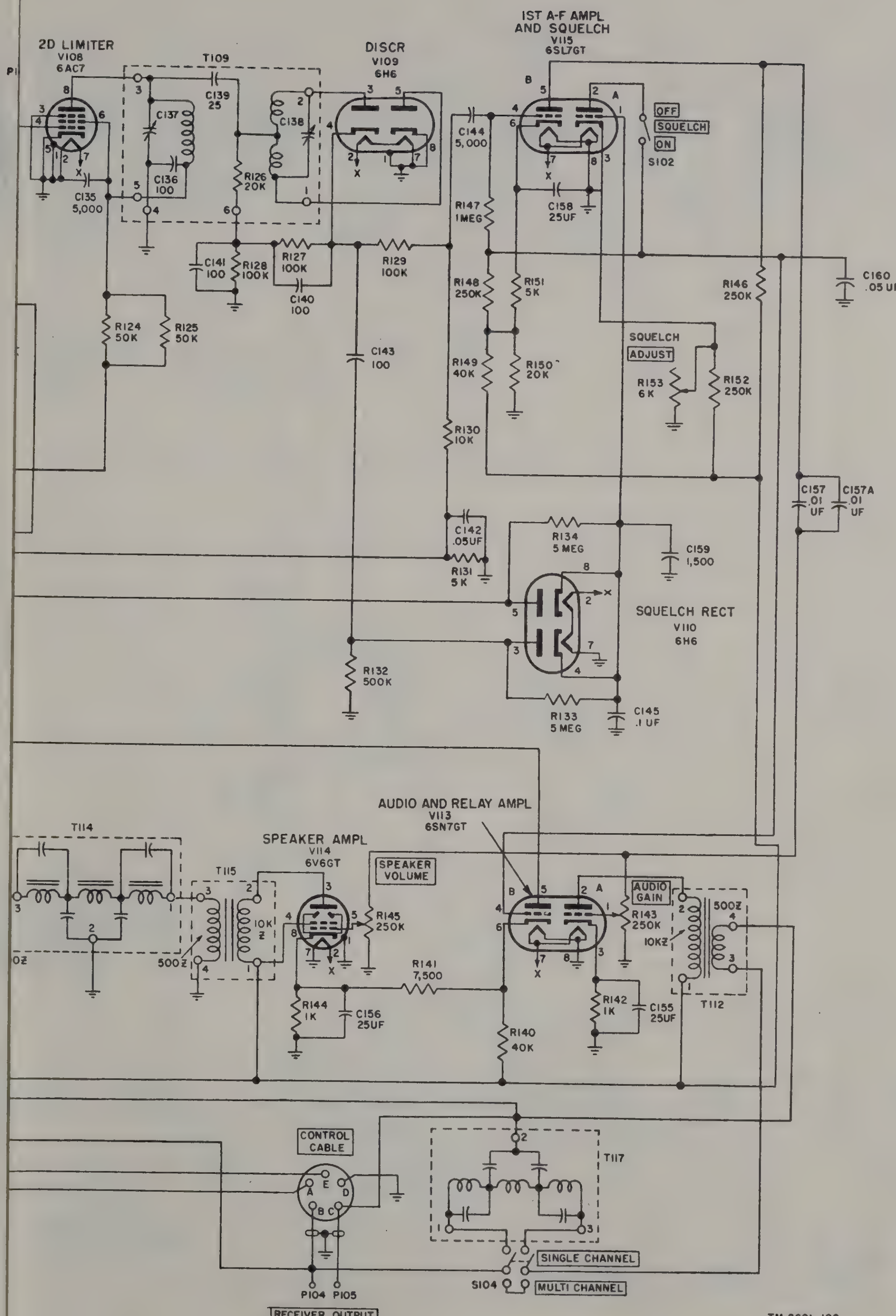
RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL 32454S

Figure 179. Resistor color codes.


2D LIMITER
V108
6AC7
T109
C137
C139
25
C136
100
C135
5,000
DISCR
V109
6H6
C138
R126
20K
C141
100
R128
100K
R127
100K
C140
100
R129
100K
R124
50K
R125
50K
C143
100
1ST A-F AMPL
AND SQUELCH
V115
6SL7GT
C144
5,000
OFF
SQUELCH
ON
S102
C158
25UF
R147
1MEG
R148
250K
R151
5K
R149
40K
R150
20K
C160
.05 UF
R146
250K
SQUELCH
ADJUST
R153
6K
R152
250K
R130
10K
C157
.01
UF
C157A
.01
UF
C142
.05UF
R131
5K
R134
5 MEG
C159
1,500
SQUELCH RECT
V110
6H6
R132
500K
R133
5 MEG
C145
.1 UF
AUDIO AND RELAY AMPL
V113
6SN7GT
T114
T115
SPEAKER AMPL
V114
6V6GT
SPEAKER
VOLUME
R145
250K
10K Z
500 Z
AUDIO
GAIN
R143
250K
500Z
10KZ
T112
R141
7,500
R144
1K
C156
25UF
R142
1K
C155
25UF
R140
40K
CONTROL
CABLE
T117
SINGLE CHANNEL
S104
MULTI CHANNEL
P104
P105
RECEIVER OUTPUT

TM 2601-100

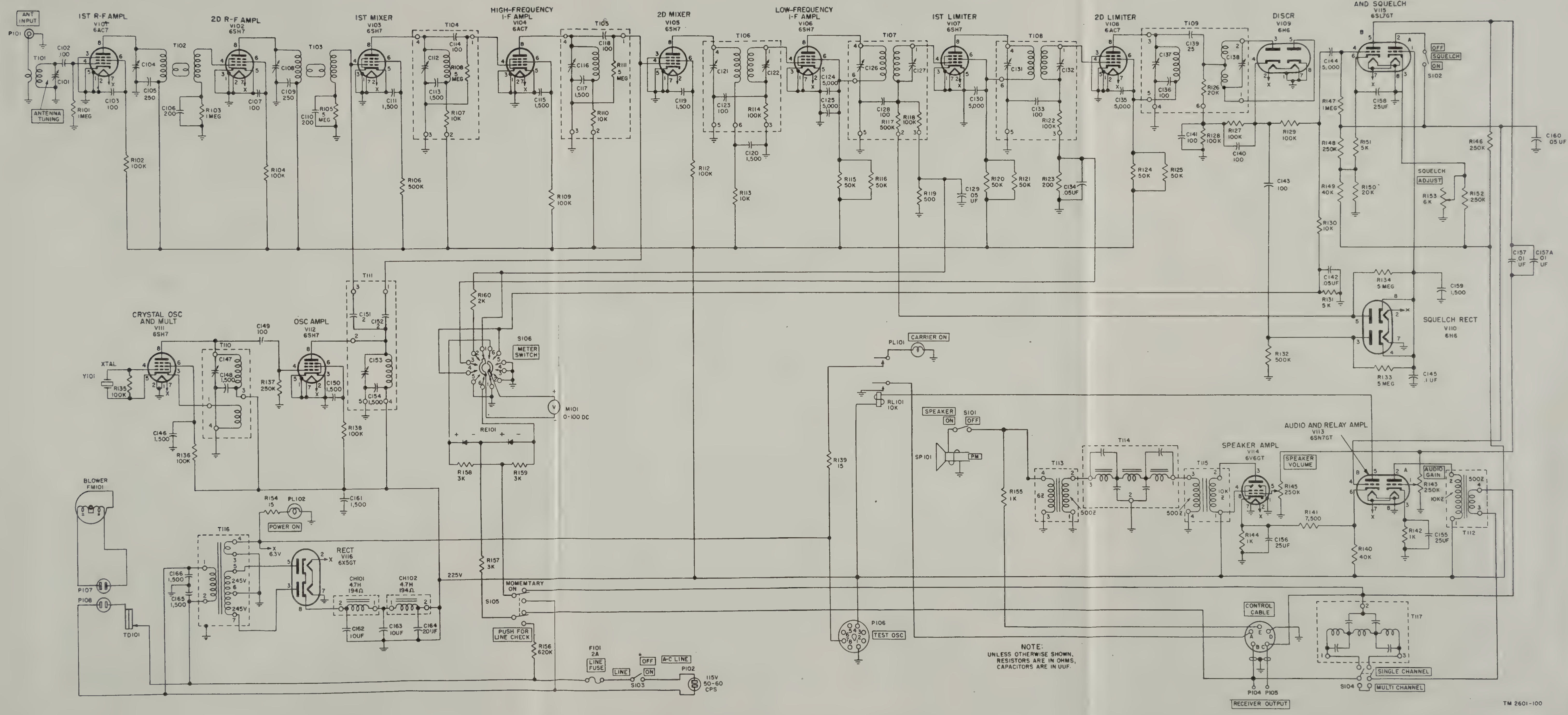
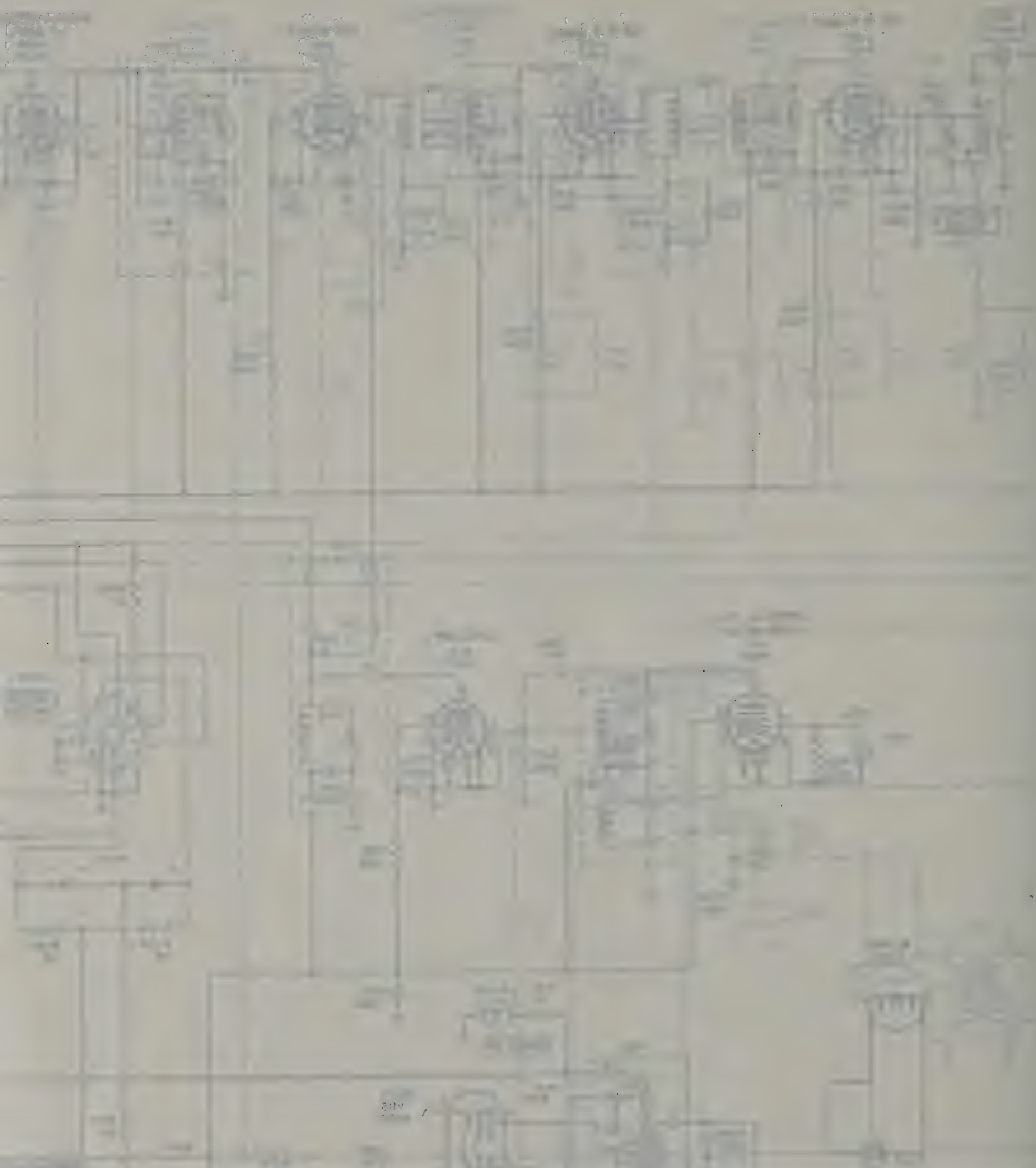
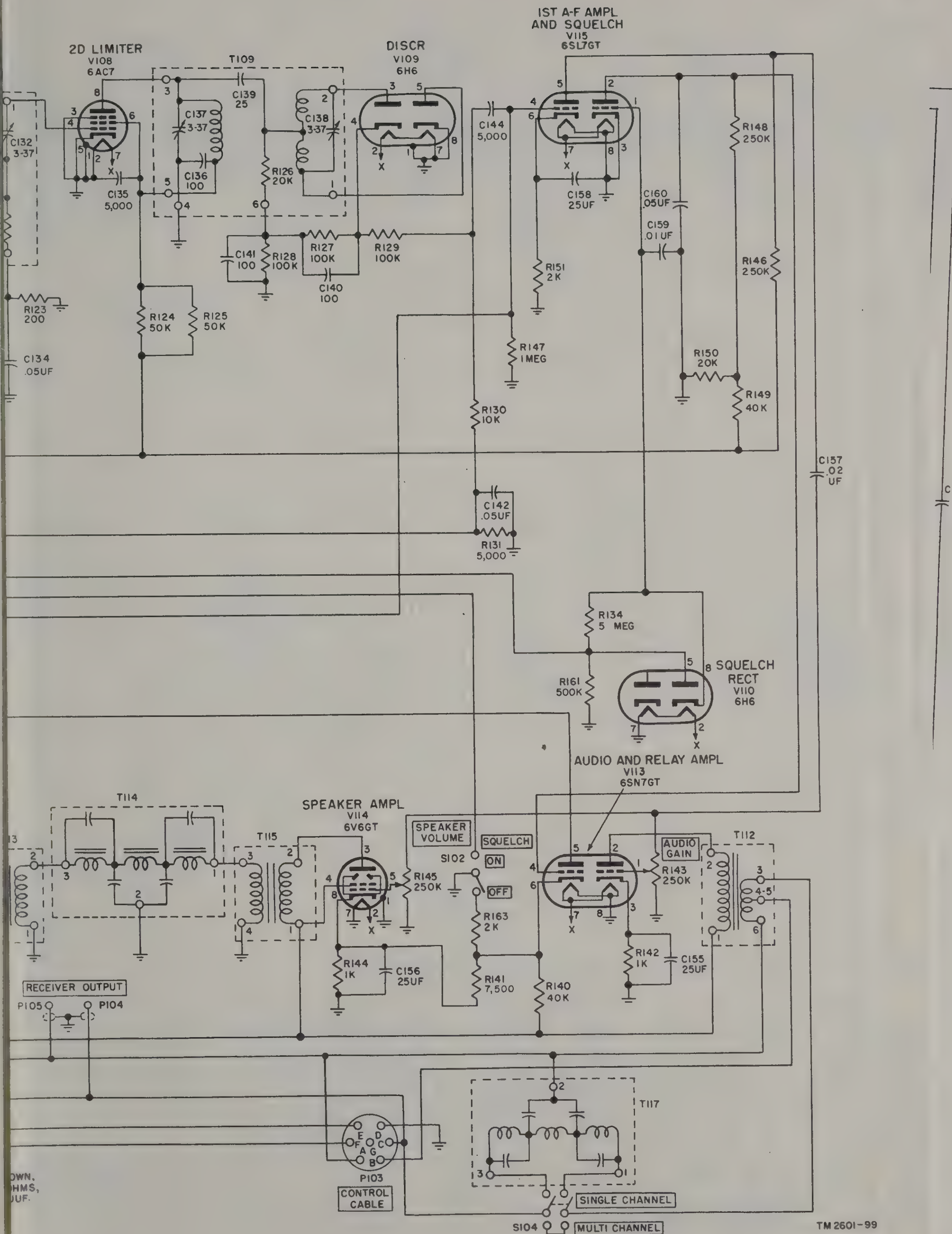


Figure 180. Radio Receiver R–19/TRC–1, schematic diagram.




2D LIMITER
V108
6AC7
T109
DISCR
V109
6H6
IST A-F AMPL
AND SQUELCH
V115
6SL7GT
C132
3-37
C137
3-37
C139
25
C138
3-37
C136
100
C135
5,000
R126
20K
C144
5,000
C158
25UF
R148
250K
C160
.05UF
C159
.01 UF
R146
250K
C141
100
R128
100K
R127
100K
R129
100K
C140
100
R151
2K
R123
200
R124
50K
R125
50K
C134
.05UF
R147
1MEG
R150
20K
R149
40K
R130
10K
C157
.02
UF
C142
.05UF
R131
5,000
R134
5 MEG
R161
500K
SQUELCH
RECT
V110
6H6
AUDIO AND RELAY AMPL
V113
6SN7GT
T114
SPEAKER AMPL
V114
6V6GT
T115
SPEAKER
VOLUME
SQUELCH
S102
ON
OFF
R145
250K
AUDIO
GAIN
R143
250K
T112
R163
2K
R144
1K
C156
25UF
R141
7,500
R140
40K
R142
1K
C155
25UF
RECEIVER OUTPUT
P105
P104
T117
P103
CONTROL
CABLE
SINGLE CHANNEL
S104
MULTI CHANNEL
TM 2601-99

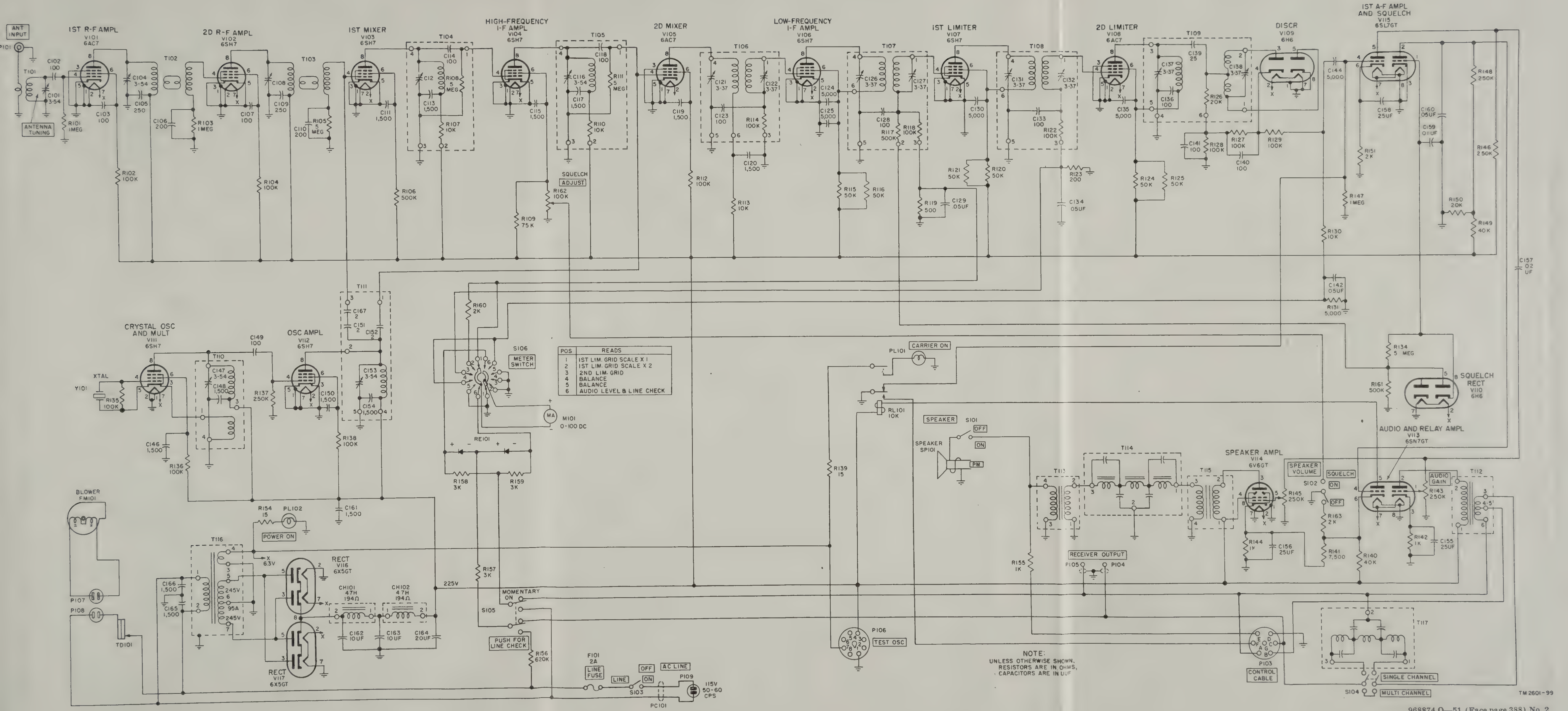
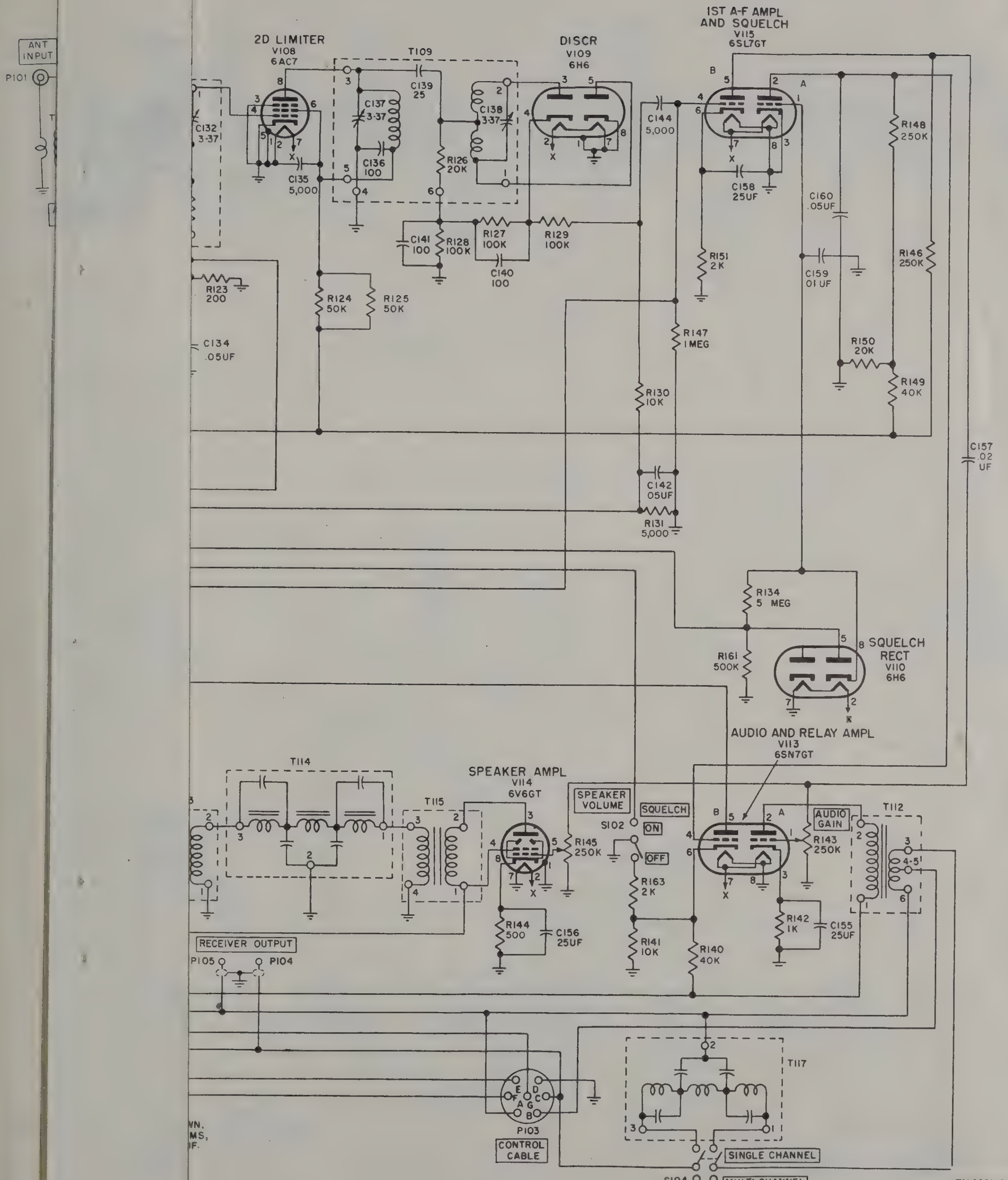


Figure 181. Radio Receivers R–19A/TRC–1 through R–19C/TRC–1, schematic diagram.



ANT INPUT
P101
2D LIMITER
V108
6AC7
T109
DISCR
V109
6H6
1ST A-F AMPL AND SQUELCH
V115
6SL7GT
C132 3-37
C137 3-37
C139 25
C138 3-37
C144 5,000
C136 100
C135 5,000
R126 20K
R148 250K
C158 25UF
C160 .05UF
C141 100
R128 100K
R127 100K
R129 100K
C140 100
R151 2K
C159 .01 UF
R146 250K
R123 200
R124 50K
R125 50K
R147 1MEG
R150 20K
R149 40K
C134 .05UF
R130 10K
C157 .02 UF
C142 .05UF
R131 5,000
R134 5 MEG
R161 500K
SQUELCH RECT
V110
6H6
AUDIO AND RELAY AMPL
V113
6SN7GT
T114
SPEAKER AMPL
V114
6V6GT
T115
SPEAKER VOLUME
S102
SQUELCH
ON
OFF
R145 250K
AUDIO GAIN
R143 250K
T112
R163 2K
R141 10K
R140 40K
R142 1K
C155 25UF
R144 500
C156 25UF
RECEIVER OUTPUT
P105
P104
T117
P103
CONTROL CABLE
SINGLE CHANNEL
S104
MULTI CHANNEL
TM 2601-98

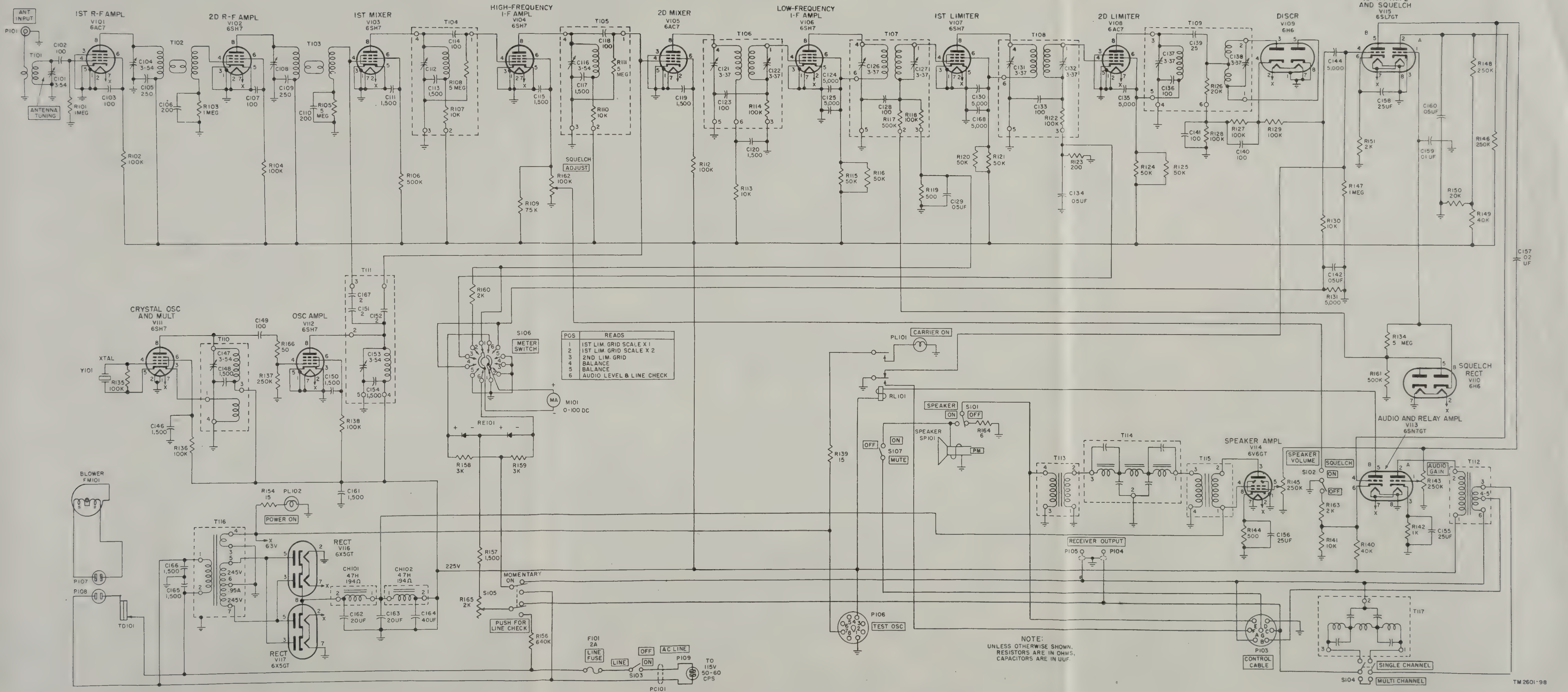
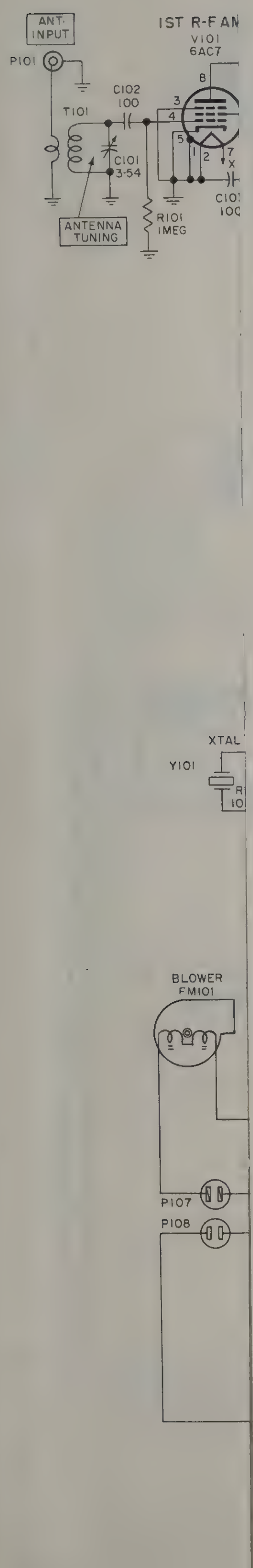
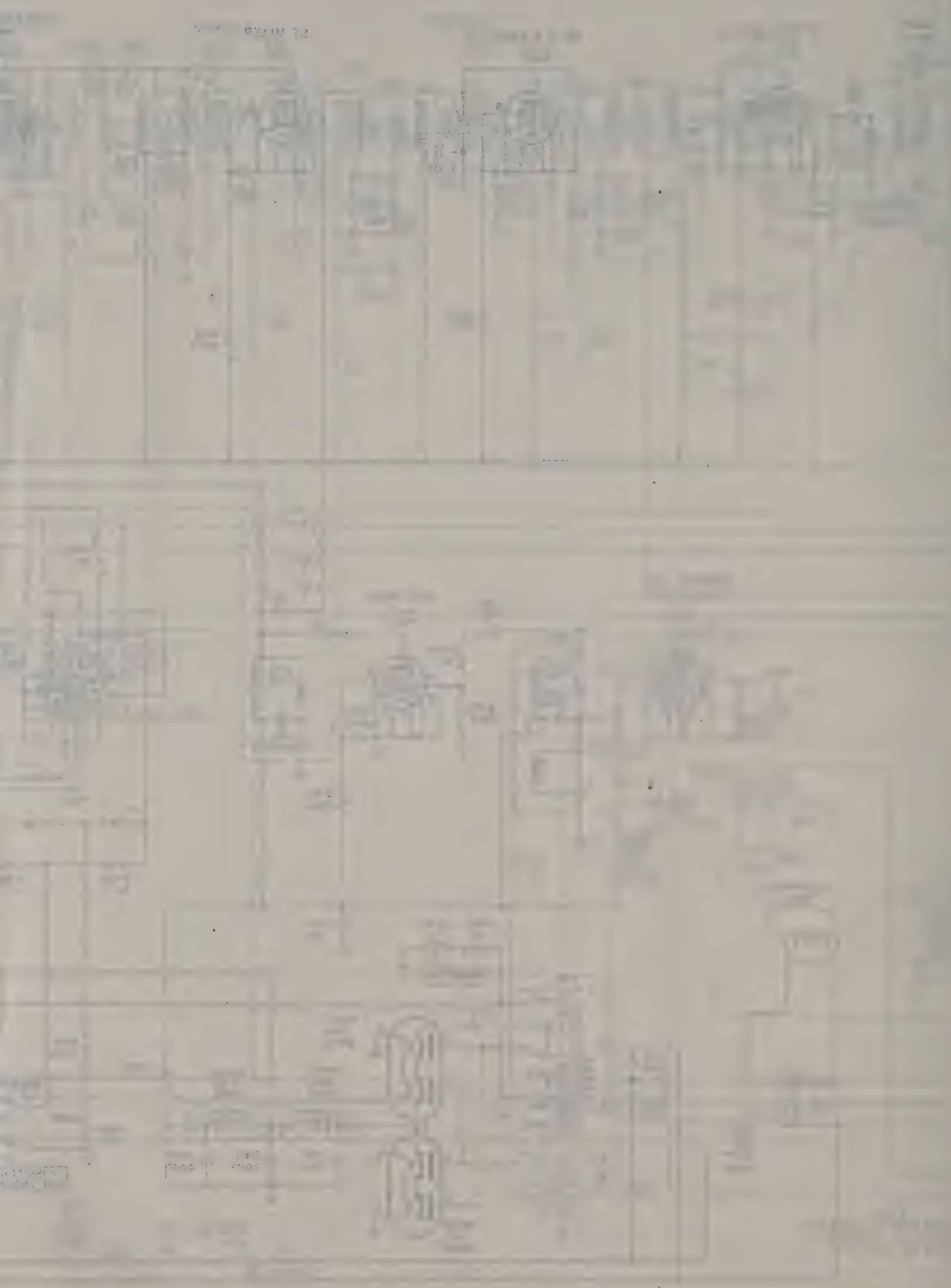


Figure 182. Radio Receivers R–19D/TRC–1 and R–19E/TRC–1, schematic diagram.


ANT. INPUT
P101
IST R-F AM
V101
6AC7
C102
100
T101
C101
3-54
C103
100
R101
1MEG
ANTENNA TUNING
XTAL
Y101
BLOWER
FM101
P107
P108



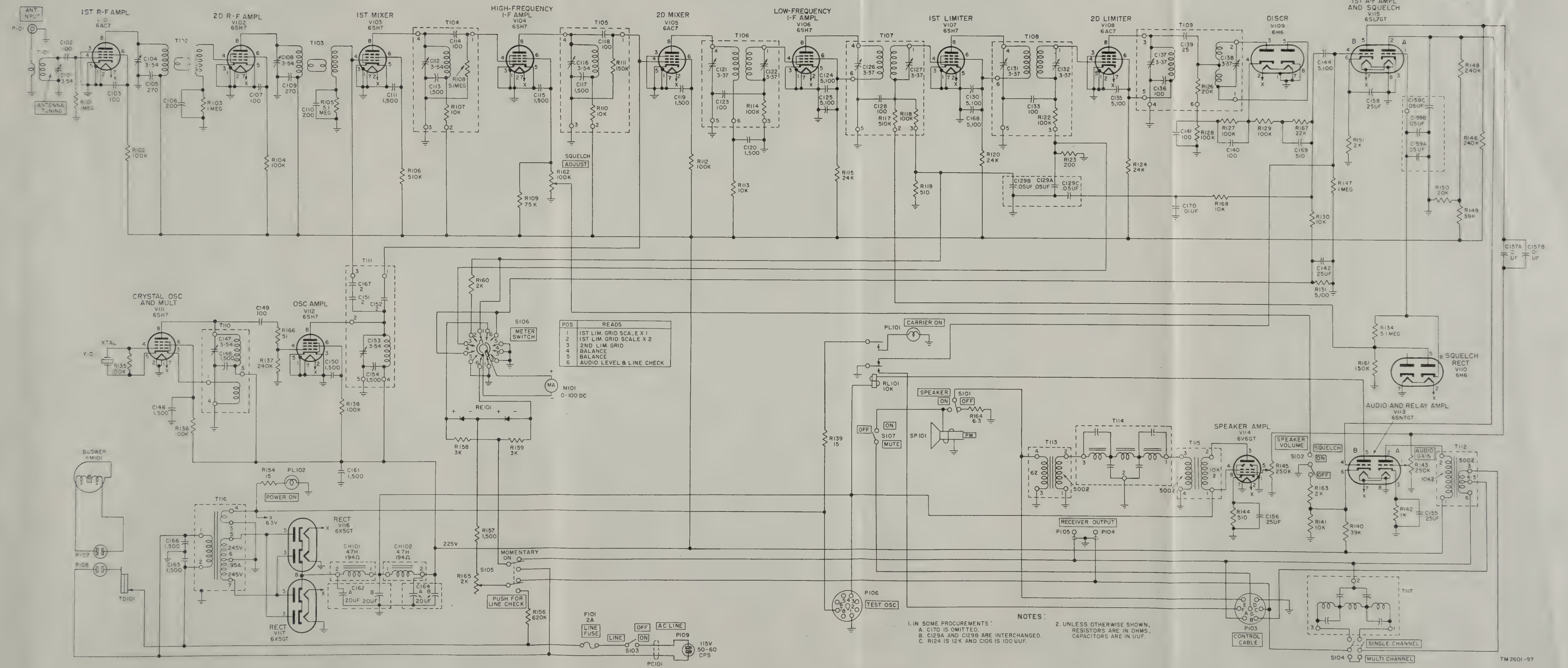
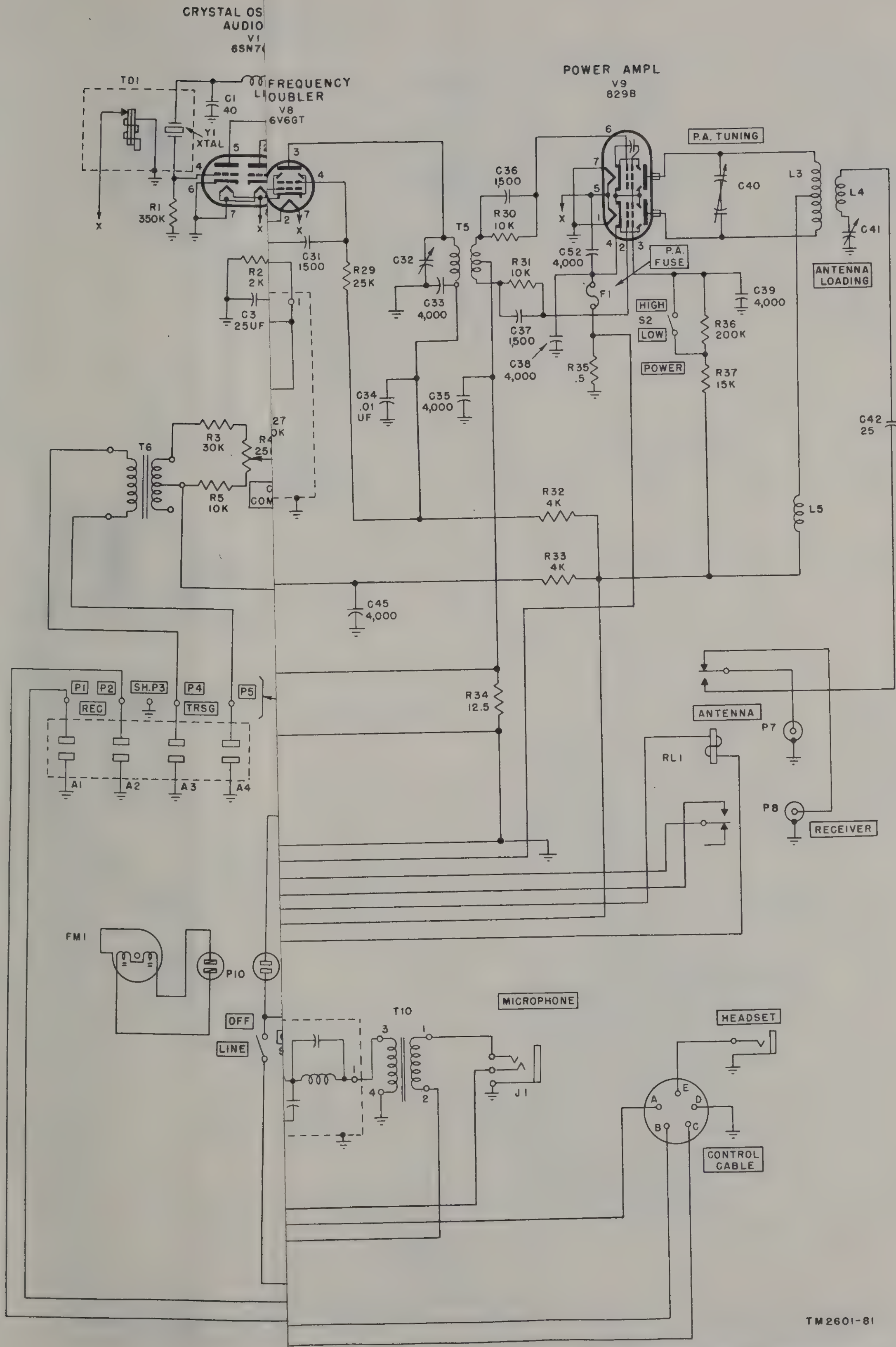
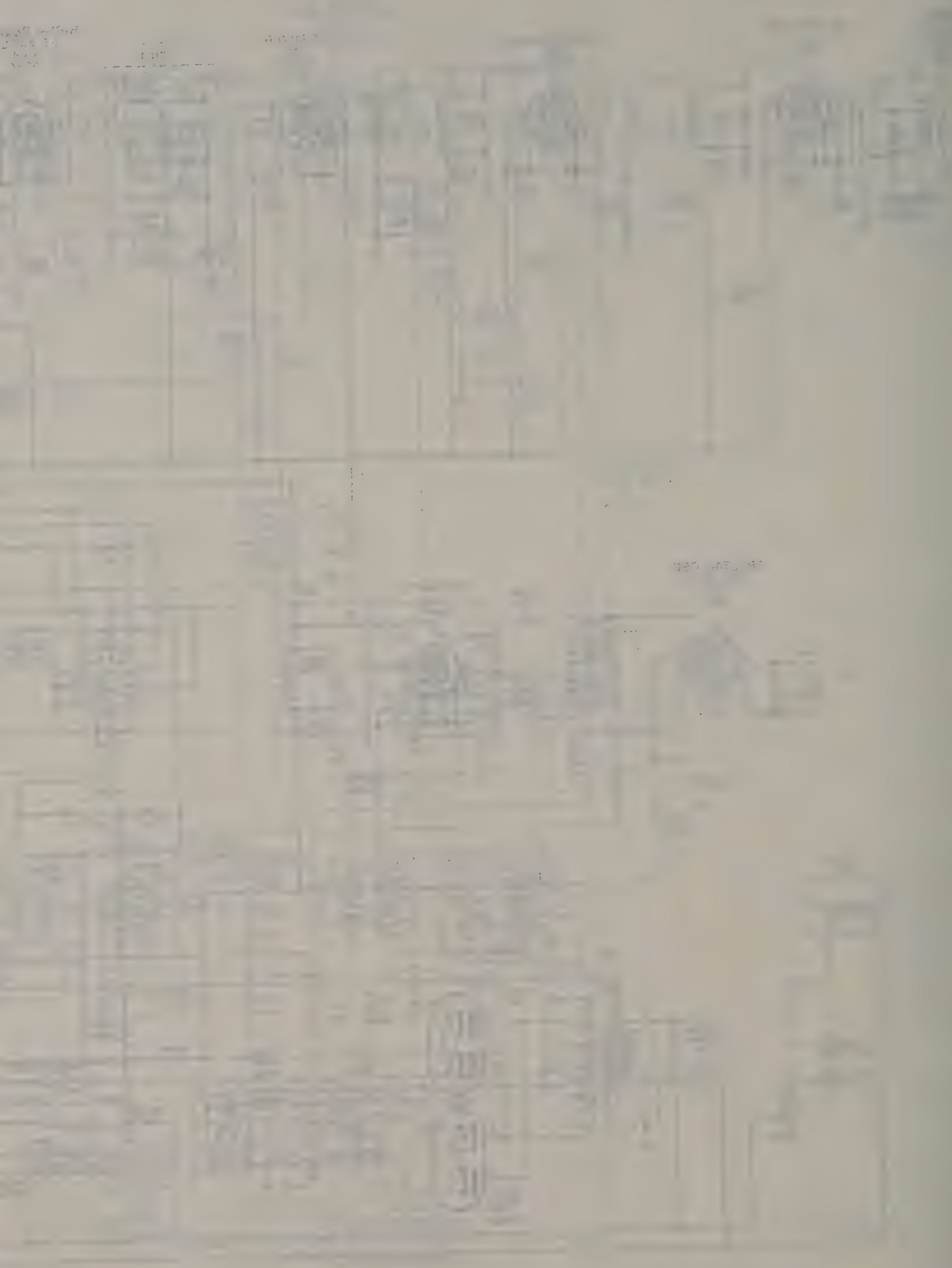


Figure 183. Radio Receiver R–19H/TRC–1, schematic diagram.


CRYSTAL OS
AUDIO
V1
6SN7
FREQUENCY
OUBLER
V8
6V6GT
POWER AMPL
V9
829B
TD1
C1
40
L1
Y1
XTAL
R1
350K
C31
1500
R2
2K
C3
25UF
R29
25K
C32
T5
C33
4,000
C36
1500
R30
10K
R31
10K
C37
1500
C38
4,000
C34
.01
UF
C35
4,000
C52
4,000
P.A. FUSE
F1
R35
.5
P.A. TUNING
C40
L3
L4
C41
ANTENNA LOADING
C39
4,000
HIGH
S2
LOW
POWER
R36
200K
R37
15K
C42
25
T6
R3
30K
R4
25
27
0K
R5
10K
COM
R32
4K
R33
4K
L5
C45
4,000
P1
P2
SH.P3
P4
P5
REC
TRSG
A1
A2
A3
A4
R34
12.5
ANTENNA
P7
RL1
P8
RECEIVER
FM1
P10
OFF
LINE
MICROPHONE
T10
J1
HEADSET
CONTROL CABLE
TM2601-81



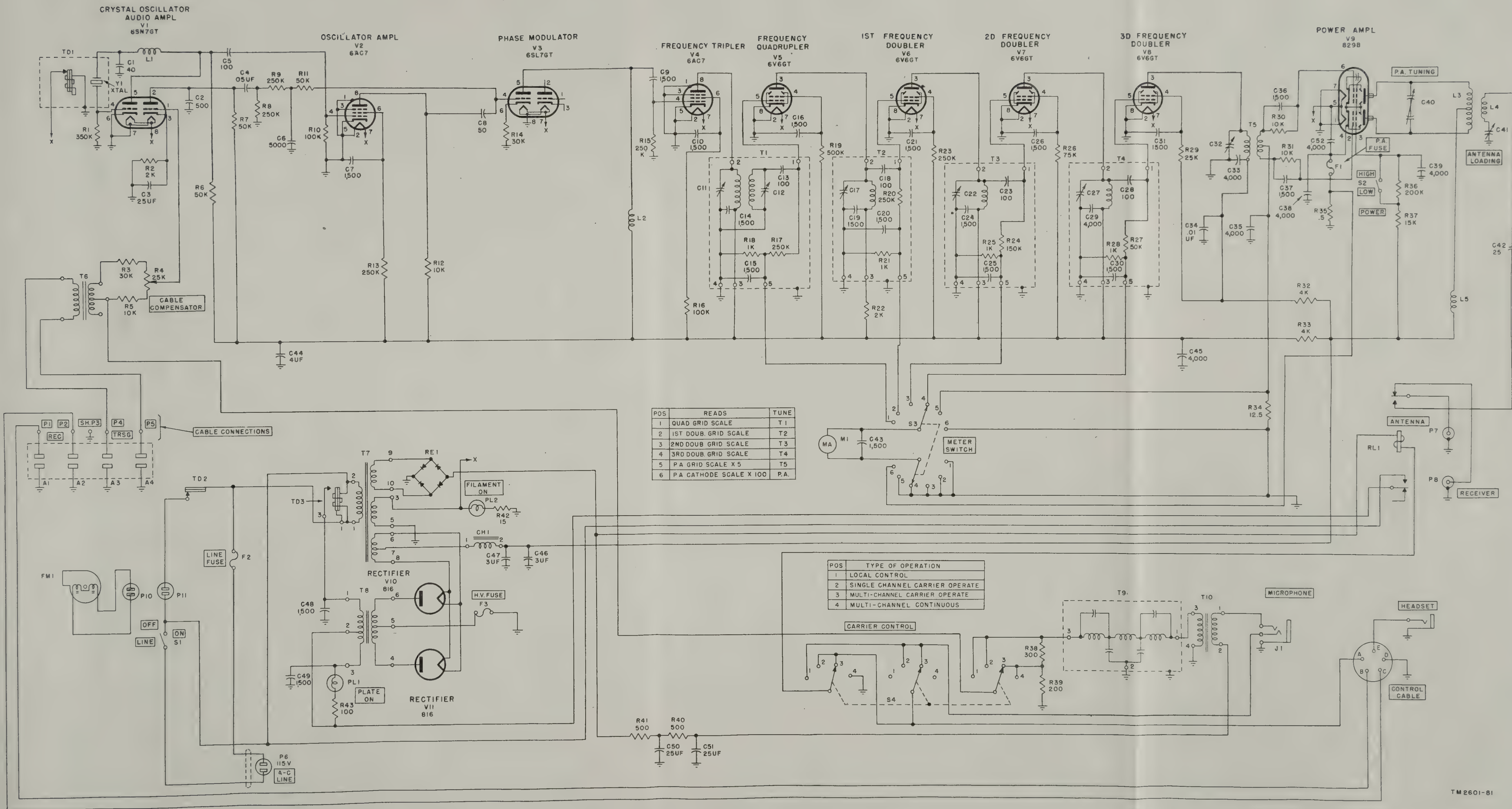
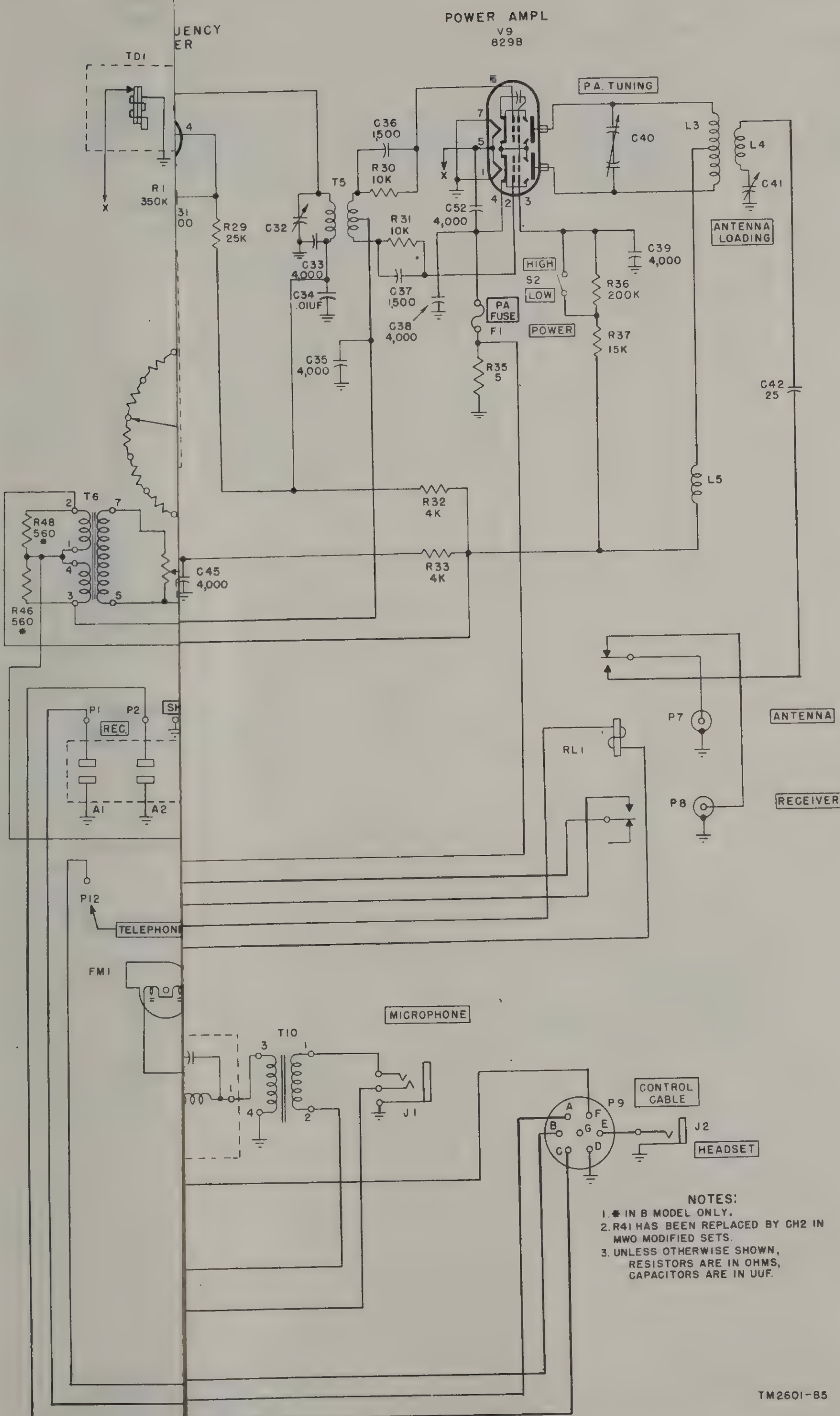
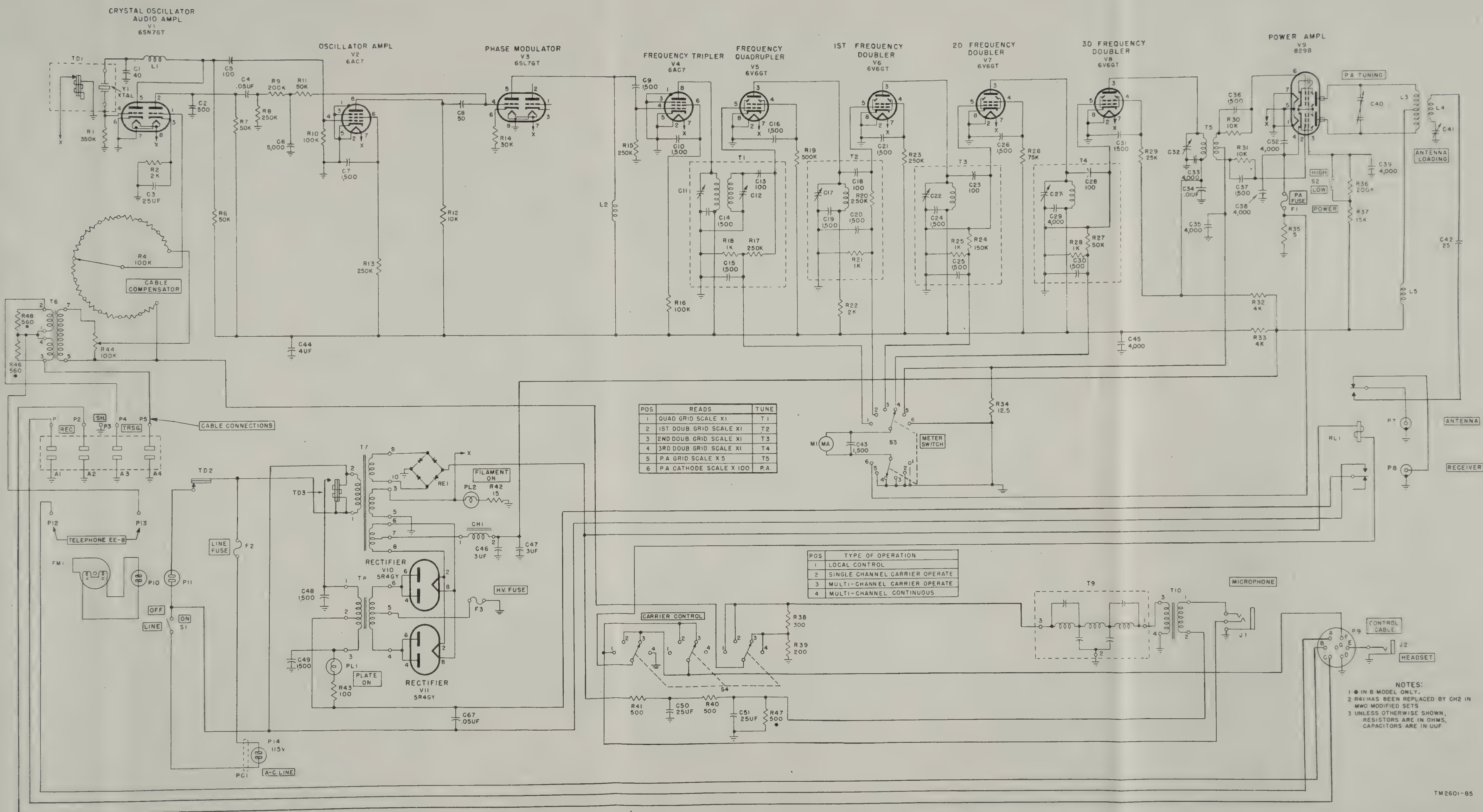


Figure 184. Radio Transmitter T-14/TRC-1, schematic diagram.


POWER AMPL
V9
829B
UENCY
ER
TD1
P.A. TUNING
C36
1500
R30
10K
T5
R31
10K
C32
C33
4,000
C34
.01UF
C37
1500
C38
4,000
C35
4,000
C52
4,000
R1
350K
R29
25K
C40
L3
L4
C41
ANTENNA
LOADING
C39
4,000
HIGH
S2
LOW
POWER
R36
200K
R37
15K
PA
FUSE
F1
R35
5
C42
25
L5
T6
R48
560
R46
560
C45
4,000
R32
4K
R33
4K
P1
P2
REC.
A1
A2
P7
ANTENNA
RL1
P8
RECEIVER
P12
TELEPHONE
FM1
MICROPHONE
T10
J1
CONTROL
CABLE
P9
J2
HEADSET
NOTES:
1. * IN B MODEL ONLY.
2. R41 HAS BEEN REPLACED BY CH2 IN
MWO MODIFIED SETS.
3. UNLESS OTHERWISE SHOWN,
RESISTORS ARE IN OHMS,
CAPACITORS ARE IN UUF.

TM2601-85

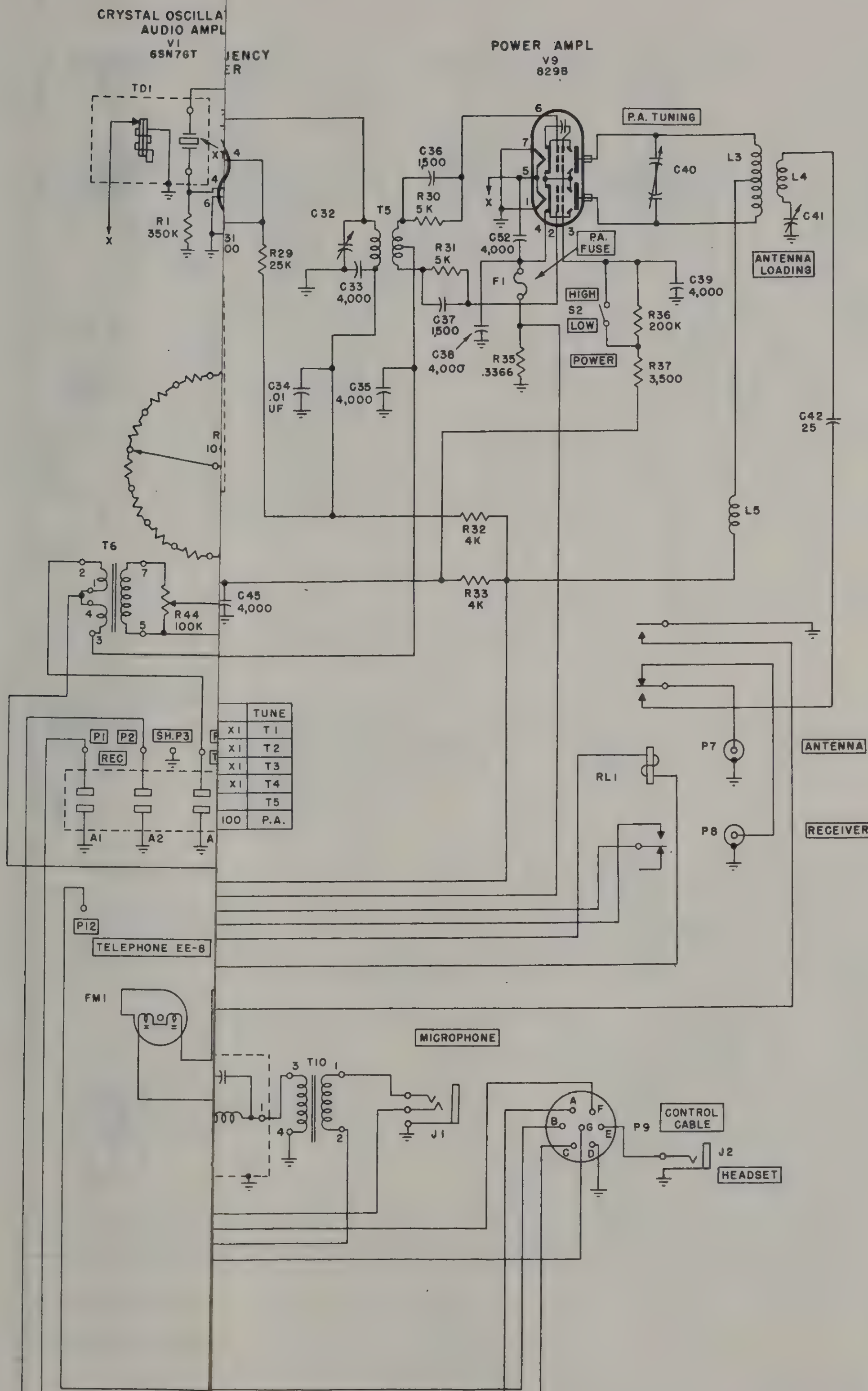


POS	READS	TUNE
1	QUAD GRID SCALE X1	T1
2	1ST DOUB. GRID SCALE X1	T2
3	2ND DOUB. GRID SCALE X1	T3
4	3RD DOUB GRID SCALE X1	T4
5	P.A GRID SCALE X 5	T5
6	P.A CATHODE SCALE X 100	P.A

POS	TYPE OF OPERATION
1	LOCAL CONTROL
2	SINGLE CHANNEL CARRIER OPERATE
3	MULTI-CHANNEL CARRIER OPERATE
4	MULTI-CHANNEL CONTINUOUS

Figure 185. Radio Transmitters T-14A/TRC-1 through T-14C/TRC-1, schematic diagram.

968874 O—51 (Face page 388) No. 6



CRYSTAL OSCILLA
AUDIO AMPL
V1
6SN7GT
JENCY
ER
TD1
XT
R1
350K
R29
25K
POWER AMPL
V9
829B
P.A. TUNING
C36
1500
R30
5K
C32
T5
C40
L3
L4
C41
ANTENNA
LOADING
C52
4,000
P.A.
FUSE
R31
5K
C33
4,000
F1
C39
4,000
HIGH
S2
LOW
R36
200K
C37
1500
C38
4,000
R35
.3366
POWER
R37
3,500
C34
.01
UF
C35
4,000
C42
25
L5
R32
4K
T6
C45
4,000
R33
4K
R44
100K
TUNE
X1 T1
X1 T2
X1 T3
X1 T4
T5
100 P.A.
P1
P2
SH.P3
REC
A1
A2
P7
ANTENNA
RL1
P8
RECEIVER
P12
TELEPHONE EE-8
FM1
MICROPHONE
T10
J1
P9
CONTROL
CABLE
J2
HEADSET

TM 2601-86

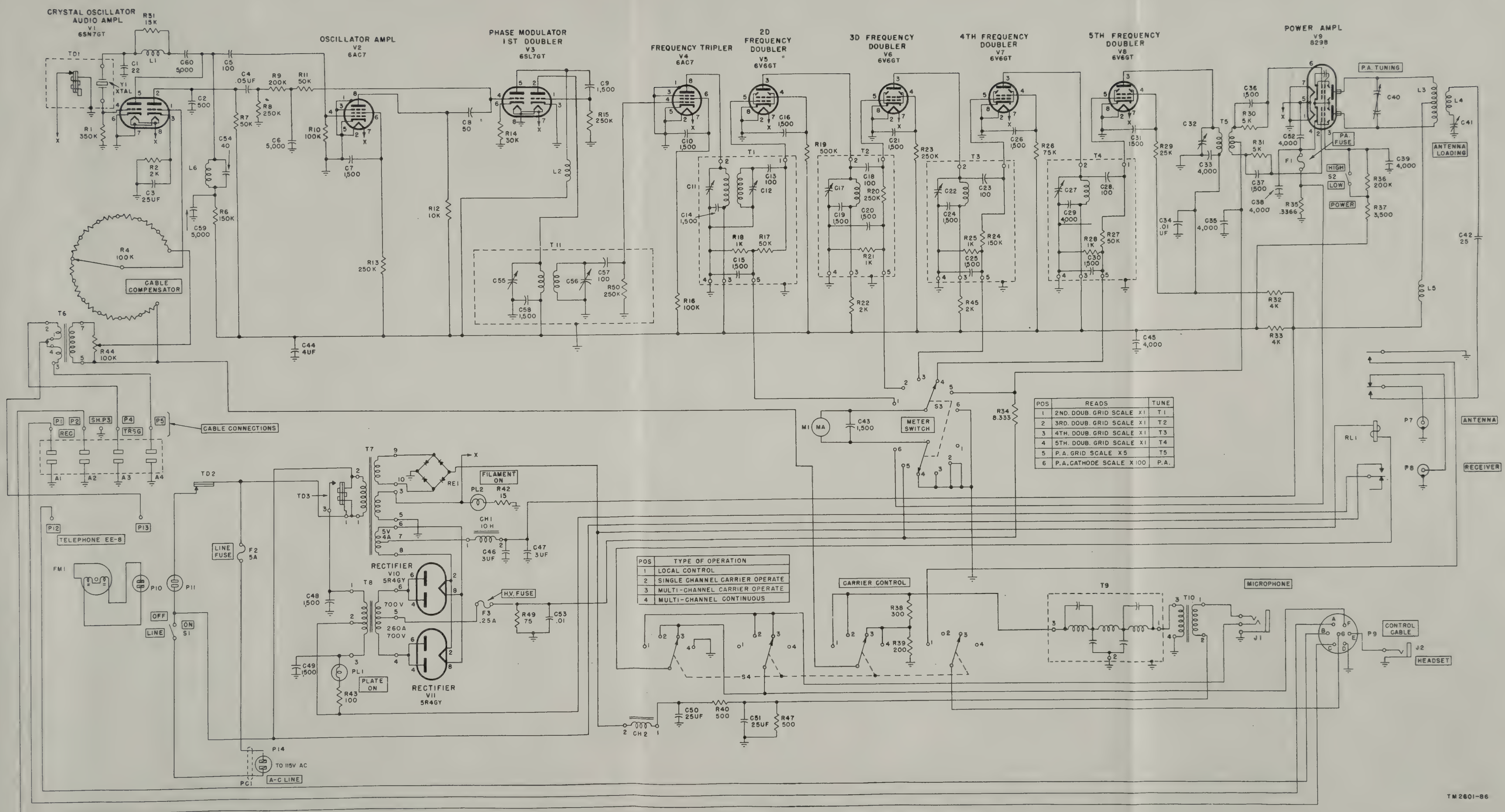
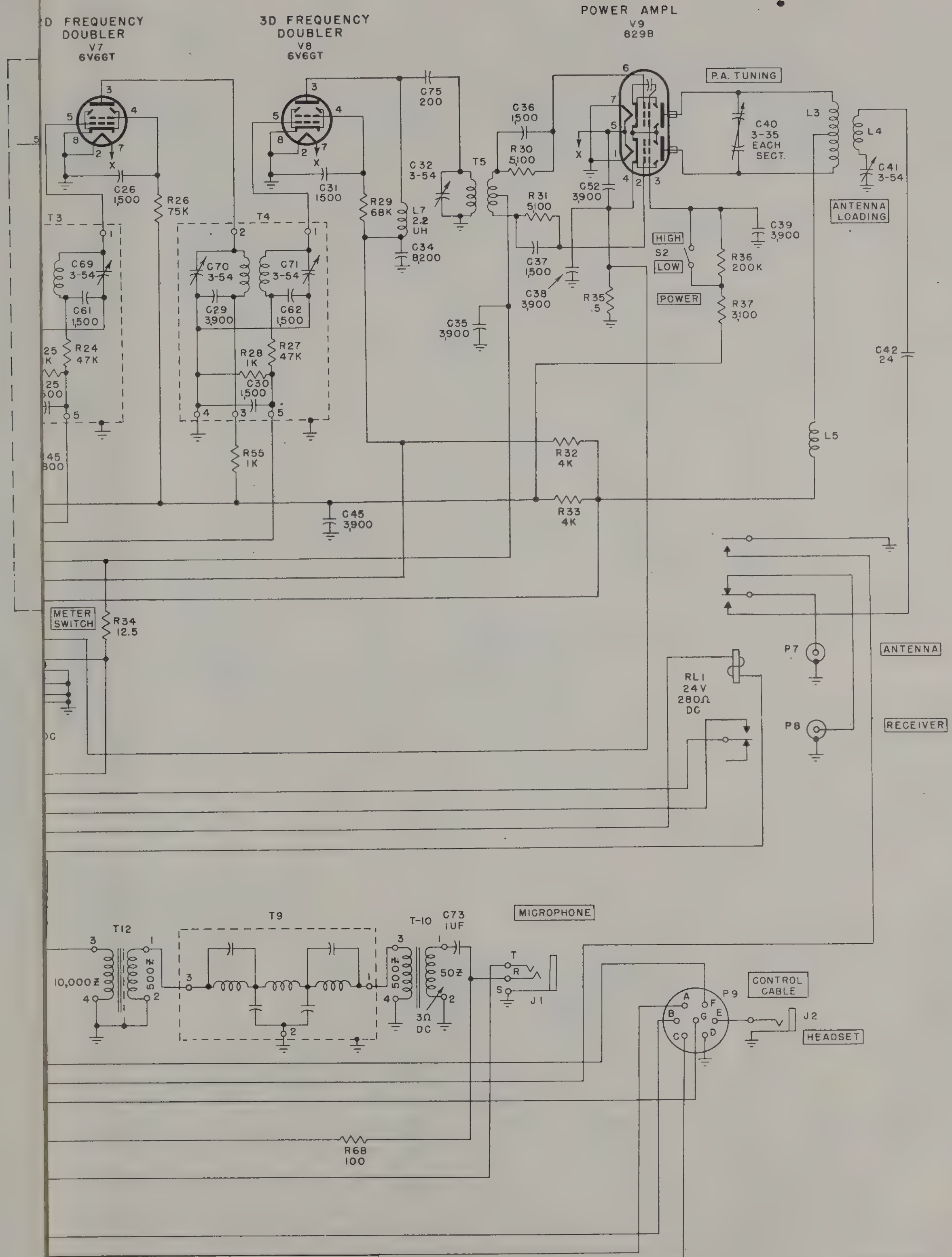
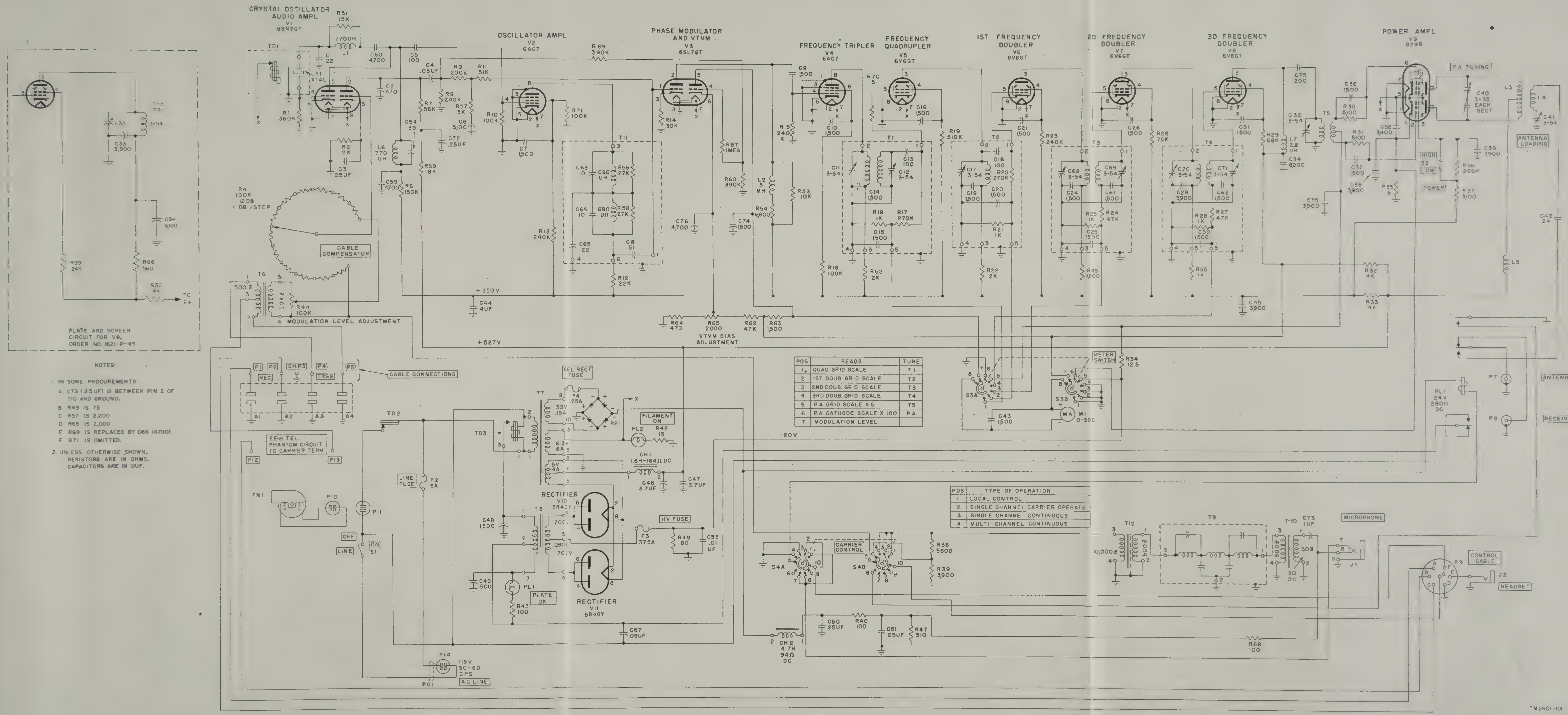


Figure 186. Radio Transmitters T-14D/TRC-1 and T-14E/TRC-1, schematic diagram.


2D FREQUENCY DOUBLER
V7
6V6GT
3D FREQUENCY DOUBLER
V8
6V6GT
POWER AMPL
V9
829B
P.A. TUNING
C75
200
C36
1500
C26
1500
R26
75K
C31
1500
R29
68K
L7
2.2
UH
C32
3-54
T5
R30
5100
C40
3-35
EACH
SECT.
L3
L4
C41
3-54
ANTENNA
LOADING
T3
T4
C69
3-54
C70
3-54
C71
3-54
C61
1500
C29
3900
C62
1500
R24
47K
R27
47K
R28
1K
C30
1500
C34
8200
R31
5100
C52
3900
C37
1500
C38
3900
C35
3900
R35
.5
HIGH
S2
LOW
POWER
C39
3900
R36
200K
R37
3100
C42
24
L5
R55
1K
R32
4K
R33
4K
C45
3900
METER
SWITCH
R34
12.5
P7
ANTENNA
P8
RECEIVER
RL1
24V
280Ω
DC
T12
10,000Z
500Z
T9
T-10
C73
1UF
500Z
50Z
3Ω
DC
MICROPHONE
J1
P9
CONTROL
CABLE
J2
HEADSET
R68
100

TM2601-101



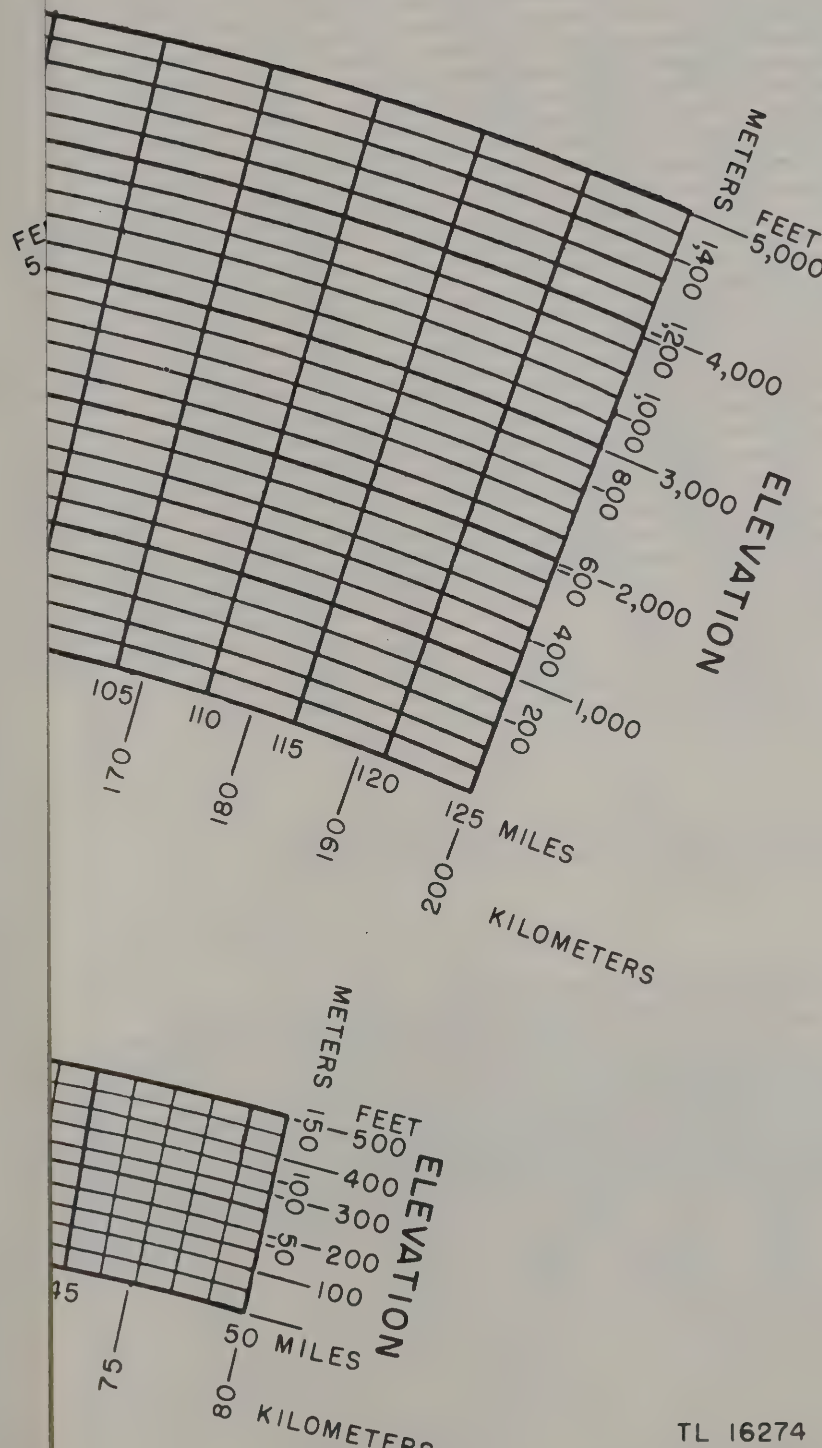
POS	READS	TUNE
1	QUAD GRID SCALE	T 1
2	1ST DOUB. GRID SCALE	T2
3	2ND DOUB. GRID SCALE	T3
4	3RD DOUB. GRID SCALE	T4
5	P.A. GRID SCALE X 5	T5
6	P.A CATHODE SCALE X 100	P.A.
7	MODULATION LEVEL	

POS	TYPE OF OPERATION
1	LOCAL CONTROL
2	SINGLE CHANNEL CARRIER OPERATE
3	SINGLE CHANNEL CONTINUOUS
4	MULTI-CHANNEL CONTINUOUS

NOTES:

1. IN SOME PROCUREMENTS:
   - A. C73 (.25 UF) IS BETWEEN PIN 2 OF T10 AND GROUND.
   - B R49 IS 75
   - C. R57 IS 2,200
   - D. R65 IS 2,000
   - E. R69 IS REPLACED BY C66 (4700).
   - F. R71 IS OMITTED.
2. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

Figure 187. Radio Transmitter T–14H/TRC–1, schematic diagram.



TL 16274

968874 O—51 (Face page 388) No. 9

GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS

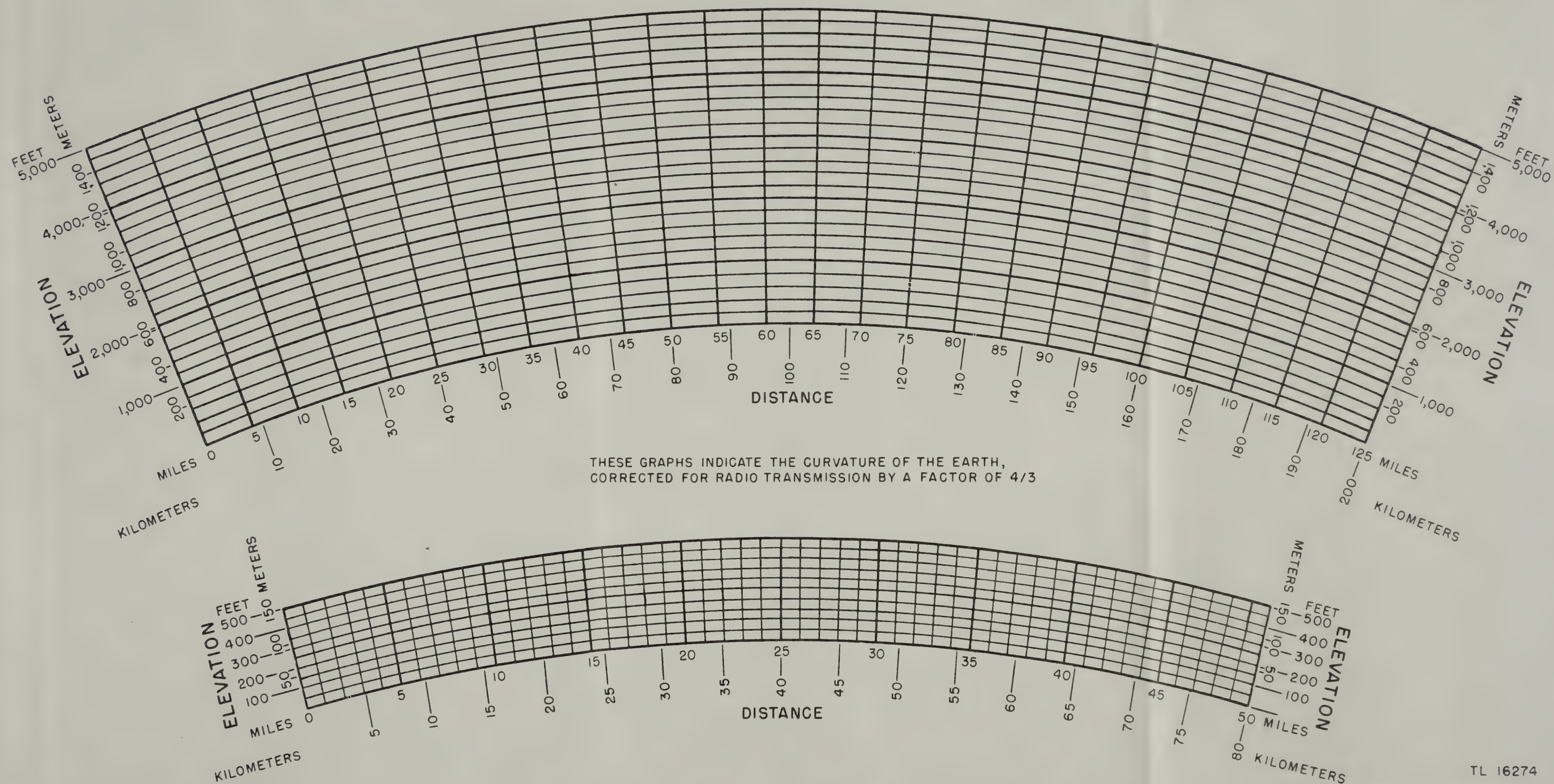
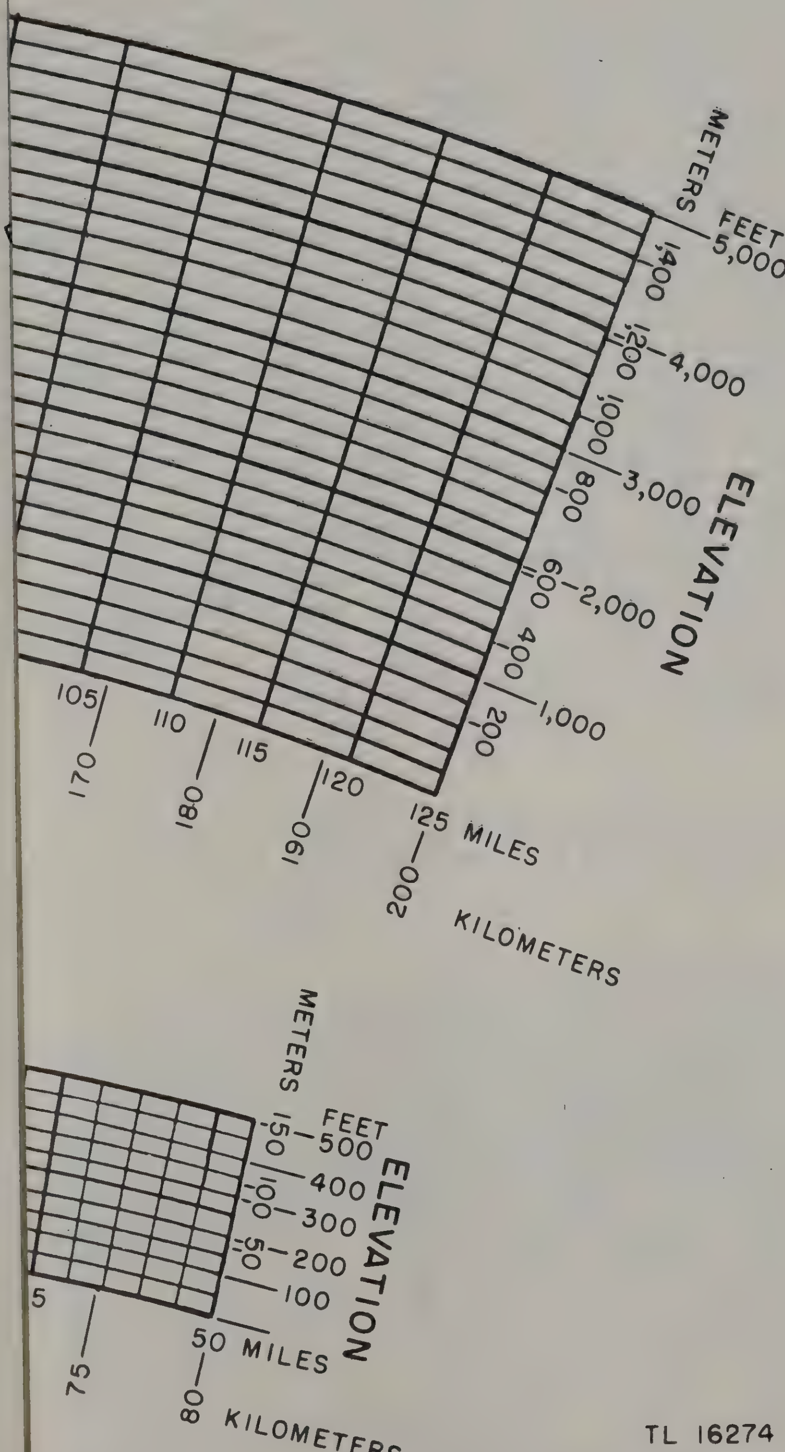


Figure 188. Nonlinear graph paper.

968874 O—51 (Face page 388) No. 9



TL 16274

968874 O—51 (Face page 388) No. 10

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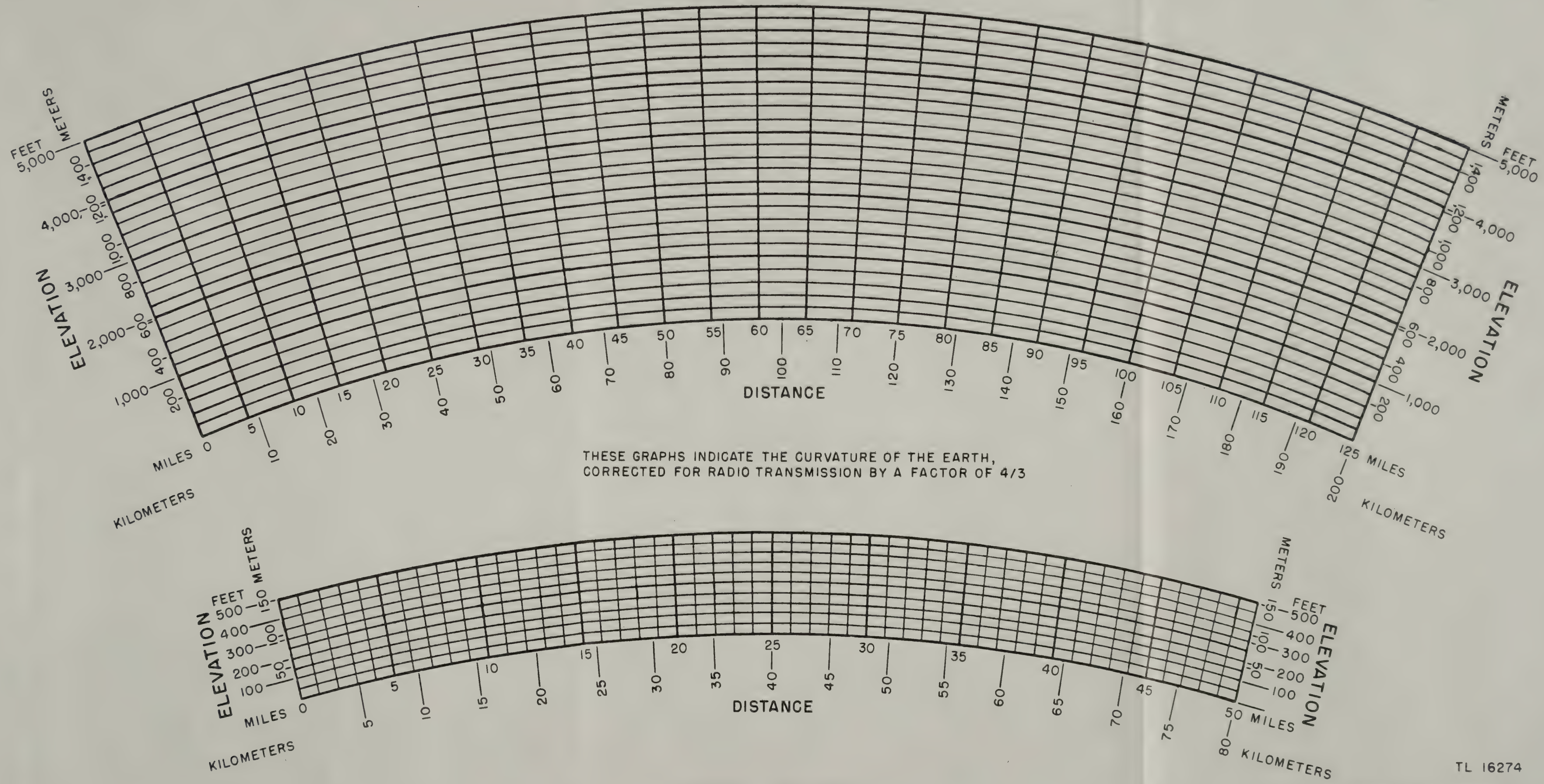
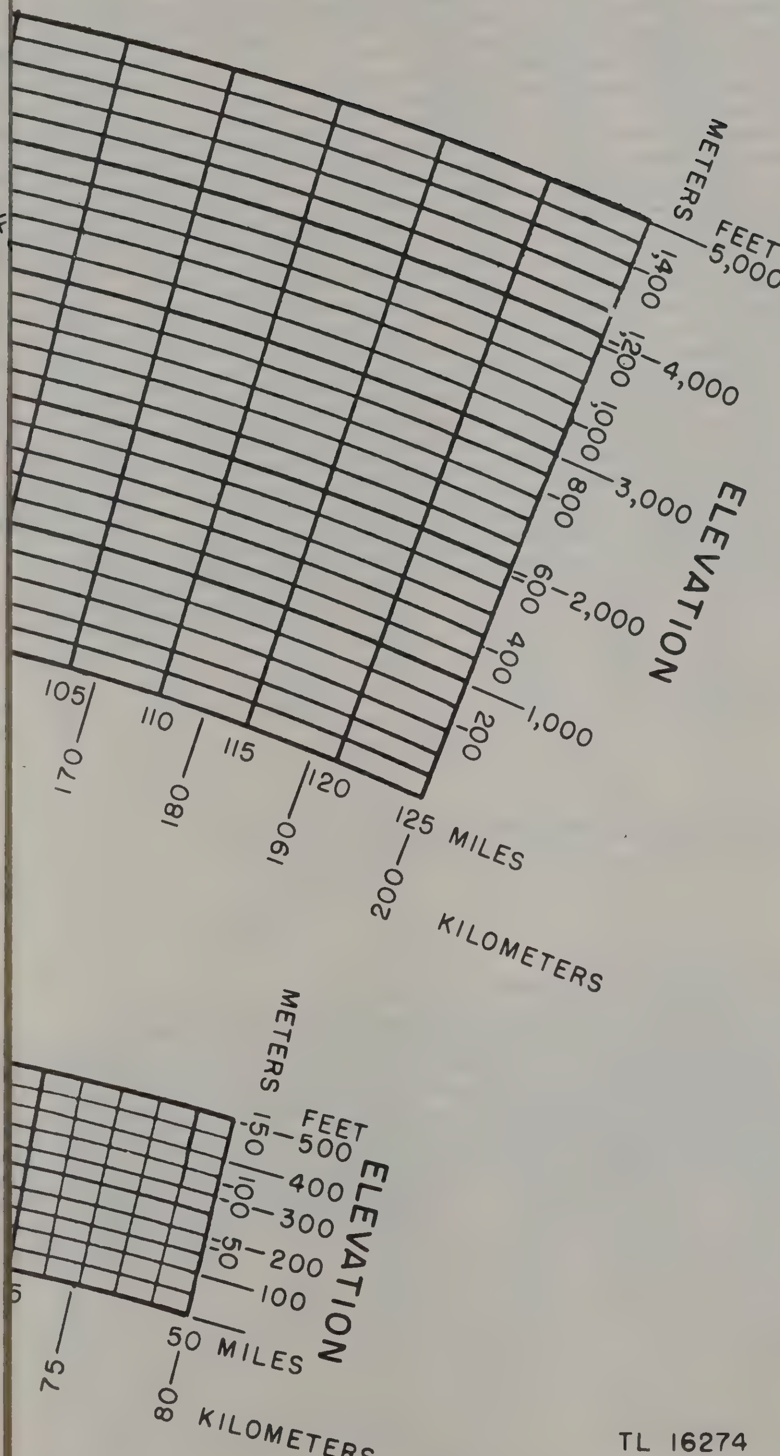


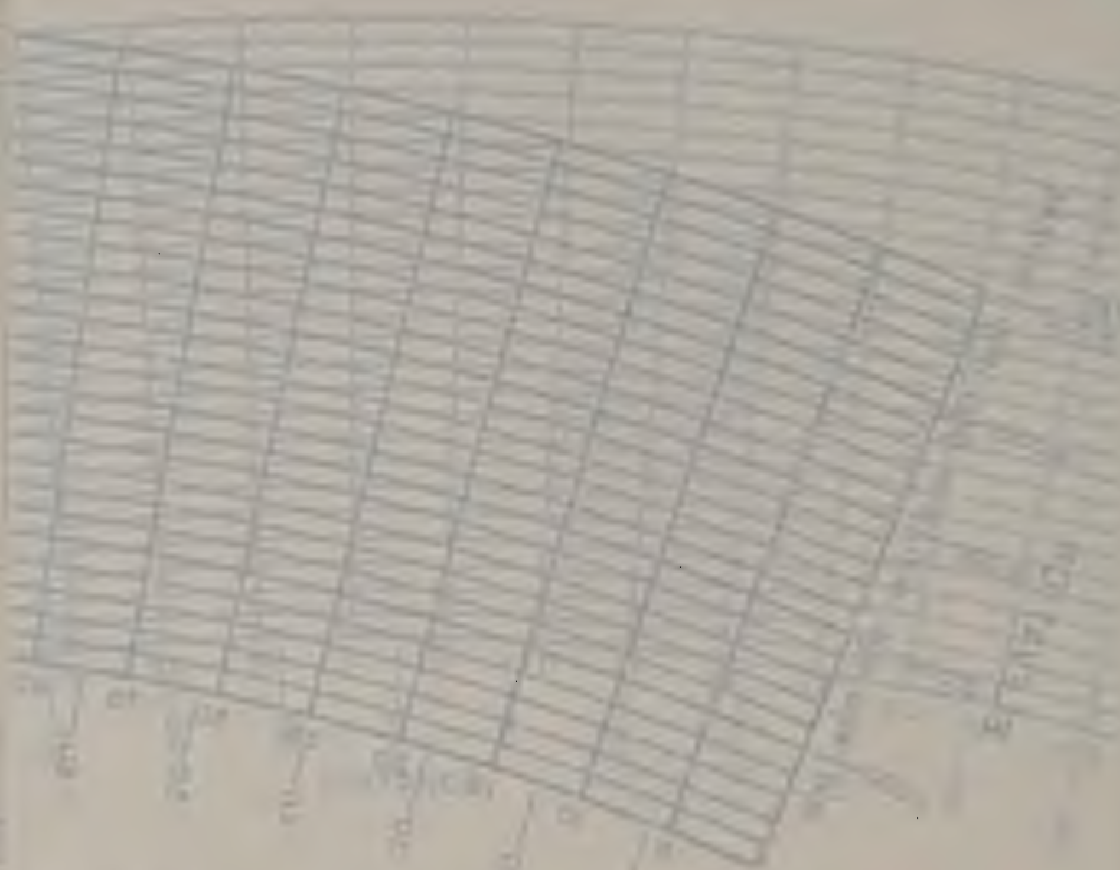
Figure 189. Nonlinear graph paper.



TL 16274

968874 O—51 (Face page 388) No. 11

PROFILES FROM CONTOUR MAPS



GRAPHS FOR PLOTTING PROFILES FROM CONTOUR MAPS

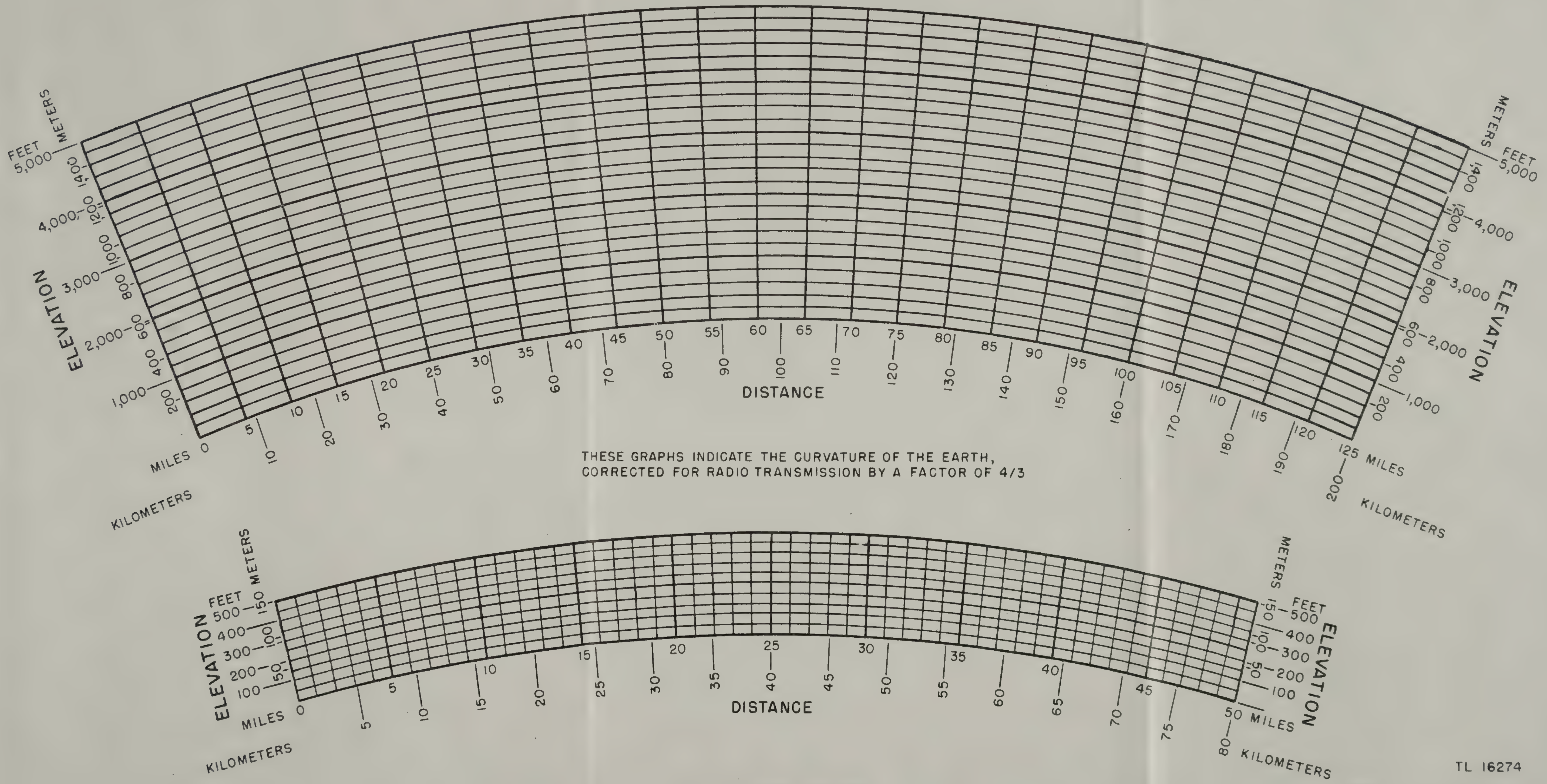


Figure 190. Nonlinear graph paper.

PROFILES FROM CONTOUR MAPS